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FAO — The Food and Agriculture Organization of the United Nations — grew out of a United Nations Conference held at Hot Springs, Virginia, U.S.A., in May 1943. The nations agreed to work together to secure a lasting peace through freedom from want. The Organization was formally founded at Quebec, Canada, in October 1945. It was located at Washington D.C. until 1951 when the Headquarters office was moved to Rome.

Unasylva is prepared by FAO's Forestry Division, directed by Mr. Marcel Leloup, and published every quarter in English, French and Spanish by the Information Division. It attempts to cover a range of interest as wide as that of the Forestry Division whose work it mirrors. Signed articles express the opinions of the authors and do not necessarily represent the views of the Organization. All material in ***Unasylva*** may be freely reprinted, but acknowledgement is requested, together with a copy of the publication containing the reprint.

Cover Photograph: *Squares of timber, hewn by local tribes, on the shore of the Ucayali river at Pucallpa, Peru. Export of timber from the Pucallpa area is mostly down the Amazon river and out into the Atlantic. Delivery of timber by road across the Andes to the capital city, Lima, has greatly increased in recent years. The road, 840 kilometers in length, represents a remarkable feat of engineering, and climbs to a height of 4,800 meters. A resource development survey of Peru is to be undertaken in 1958 jointly by FAO and the International Bank.*

Courtesy, M.A.F. Dijkmans

Unasylva

An International Review of Forestry and Forest Products

FOREST LAW

Over the past few years there has been a marked revival of interest in forest law. Some scholarly books and literature have been published on the subject. Two, on British and Italian legislation, have been reviewed recently in *Unasylva*.

Of greater interest, however, is the fact that many countries have indicated their intention to bring their forest laws into line with modern circumstances or else to codify dispersed texts. This is happening in France and Spain. Other countries, mostly in Latin America, intend to promulgate their first forest laws, or to put into effect laws that for the first time really correspond to their needs, environment and actual economic and social conditions, and to the real possibilities of enforcement. Honduras and Ecuador have recently gazetted forest laws, while drafts are under examination in Peru, Cuba and Chile.

It must be admitted that forest law in many countries is still defective. This is not a matter for surprise because these same countries have not yet managed to give definition to a really national forest policy. It is easy to give recognition to the universal principles of forest policy but to interpret these principles in national terms entails not only an appreciation of the present and potential roles (physical, economic and social) that a country's forests should fill but, beyond that, decisions as to the precise objectives to be attained and how this shall be done.

A forest law is not be regarded as a charter in a void, ignoring other laws which govern the economic and social life of a country, or custom and tradition. It must necessarily be one of a piece with all these. Nor, therefore, can it be regarded as unchangeable. In fact, it must be in a continual process of evolution even in countries where the law of forestry is of long standing. Forest law must be adapted to the often rapid changes in the economic and indeed political circumstances of a country. The recent adaptation of laws in Europe to induce afforestation, in order to prevent the fragmentation of woodlands or to encourage their consolidation, is a case in point.

But one must be on guard against making a fetish of forest law. A legal prescription is undoubtedly very useful to secure forest conservation and development, particularly in countries where the forest and non-cultivated land is mostly in private hands. Yet one may observe how forestry expanded in the United Kingdom, which had no forest law proper until the beginning of this century. There are, in fact, many countries with important forest resources which still have no unified or codified forest law. Forestry development is often contingent on laws which appear to have only an indirect bearing. In many countries now in the early stages of development, such laws are generally those governing land settlement. Elsewhere, they may be the laws controlling timber trade or the import of foreign equipment. They may be fiscal laws, inheritance laws, or relating to the establishment of associations and co-operatives. The legislation being built up in the United States in connection with the soil bank may have a considerable influence on forestry. It may not be necessary in all cases, therefore, to have a separate forest law. But if a particular law is the principal expression of the forest policy, the spirit of the law, once decreed, must be reflected also in the national legislation relating to the most diverse subjects.

It is none the less true that the present active interest in forest law is indicative of real progress being made. In countries where forestry is long established, it shows that governments are seeking to integrate their forest economy into the general economy and, more particularly, to adjust policy to the very much more diversified needs for wood of the present day. In other countries, it is a manifestation of a realization of forest problems, of the need to protect natural resources, of the significance of the forest in soil conservation and watershed management, and lastly, of the potential contribution of the forest to an expanding national economy.

UNITED STATES OF AMERICA

GULF OF MEXICO

PACIFIC OCEAN

FIGURE 1. – *Area covered by the survey; shown in relation to the Republic of Mexico. Michoacán State is indicated in white, and Mexico City by a black dot within that white space.*

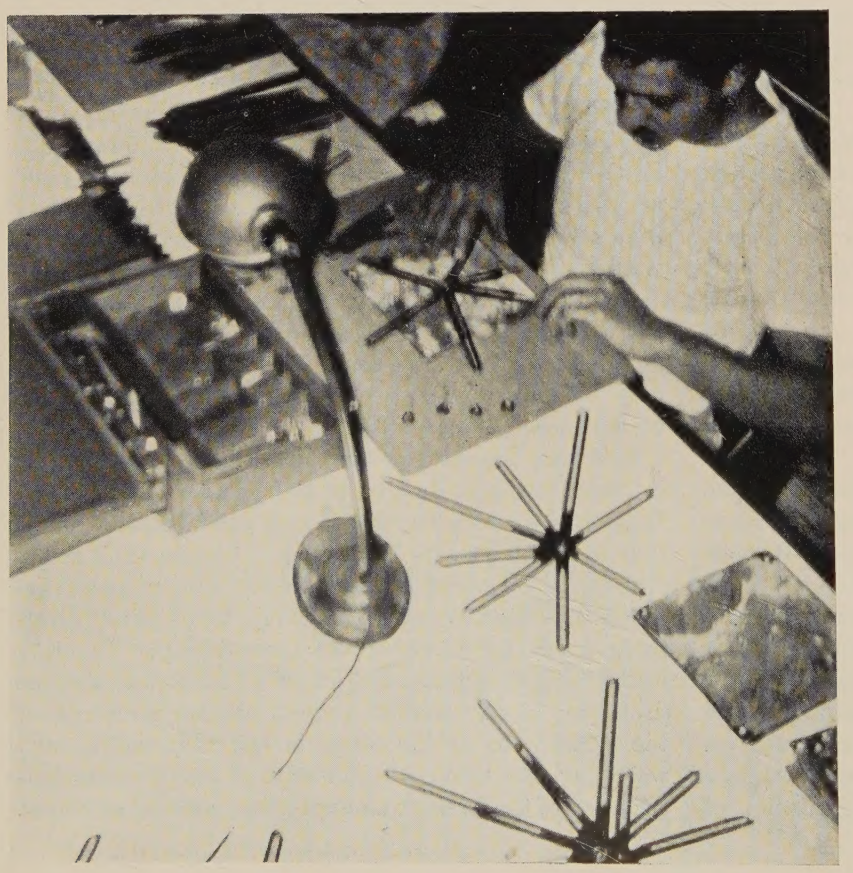


FIGURE 2. – *Setting the templates on the photographs.*

A Forest Inventory in Mexico

Norberto Sanchez Mejorada, and Abraham Escarpita H.,
Director and Assistant Director, Forest Department of *Celulosa Michoacán*, Mexico, and
Louis Huguet
FAO Technical Assistance Officer

It has been estimated that Mexico possesses some 10 million hectares of coniferous forests, one fifth still untouched. Despite these resources and its general industrialization efforts, Mexico still imports annually the whole of its newsprint consumption requirements and more than half of its paper pulp requirements, to a value of some $21,000,000. These quantities correspond to barely 500,000 cubic meters of local softwoods (*Pinus* and *Abies* spp) which, are perfectly suitable for the production of newsprint and paper pulp. Since one hectare of conifers in Mexico yields about 3 cubic meters per year, the systematic management of 200,000 hectares would suffice for producing the newsprint and pulp which now entail a considerable expenditure of foreign exchange to import.

Some time ago, the Mexican Government decided on expansion of the domestic pulp and paper industries, and for one project an area of approximately 500,000 hectares, half of which is stocked with conifers, was selected on which to base not only a pulp and newsprint mill but also an integrated series of forest industries. The selected area is situated around the city of Uruapan in Michoacán State and is 500 kilometers distant from Mexico City, the main consumption center for pulp and newsprint (see Figure 1).

The forests are chiefly stocked with pines, which were cut over for saw timber some 20 or 30 years ago. It would have been possible to find richer untouched forests in the more remote parts of Mexico, especially in the northwest, but preference was given to poorer forests easier to log, situated near the main lines of communication and the principal markets.

The study, implementation and administration of the Michoacán project, as it is called, have been entrusted to *Nacional Financiera, S. A.*, which is the official bank of Mexico for promoting and financing the industrial development of the country. Since the beginning of the project, the *Nacional Financiera* had at its disposal the services of an FAO technical assistance officer: in 1954, this officer, together with two specially-trained Mexican forest engineers (the three co-authors of this article) set about carrying out a forest inventory of the project area. This work has now been completed, and forms the subject of this article.

Scope of the Project

The general requirements of the Michoacán project were laid down as a sulphate pulp mill with a minimum capacity of 30,000 tons per year, and a newsprint mill producing about 32,000 tons of mechanical pulp which, mixed with about 8,000 tons of semibleached chemical pulp from the other mill, could produce about 40,000 tons of newsprint annually. At the same time, it was proposed to establish a sawmill which would absorb the balance of the timber supplies left over from the requirements of the two pulp mills. Ultimately, a veneer mill was envisaged to use high-grade logs and an activated charcoal plant to use the sawmill waste and the hardwoods of the area which are generally of too poor quality for conversion to lumber. All these mills were to be fully "integrated" with one another so as to ensure the most economic use of all the wood removed from the forest.

The minimum roundwood requirements for the project were estimated to be:

	cubic meters
Chemical pulp: 30,000 tons per year, equivalent to 5 m³ roundwood per ton	150,000
Mechanical pulp: about 32,000 tons, equivalent to 3 m³ roundwood per ton	100,000
Sawmill: capacity estimated at an arbitrary minimum	100,000
Total	350,000

The sawmill, however, should yield about 20 percent of its intake as edgings and "waste" which could be converted into chemical or even mechanical pulp, so that the minimum volume of log supplies required, 8 centimeters in diameter and over without bark, would be only 330,000 cubic meters annually.

The forest inventory should therefore:

1. determine whether the selected forest area could actually supply on a sustained-yield basis a minimum of 330,000 cubic meters per year, and the exact allowable cut so as to determine the definitive capacity of the proposed sawmill;
2. reveal the characteristics (species, average log length and diameter) of the log supplies which would be available for the various mills so as to plan their equipment accordingly, and permit estimates of the investment requirements;
3. permit the preparation of forest maps and the management plan, including prescriptions for cutting and extraction;
4. result in a clear cadastral or land ownership map and estimates of the allowable cut for each forest holding held by an individual owner, of which there were over 3,000.

First Stage: Preliminary Cruising

It was necessary to verify rapidly that the allowable cut of the forest was at least equal to the 330,000 cubic meters required by the contemplated project. A preliminary cruise was accordingly carried out in November and December 1953.

A start was made by assembling all the available material on the forests in this area: studies, sketches, maps, triangulation points, old aerial photographs, etc. Then reconnaissance surveys were made by all available means, on foot, on horseback, by light motor lorry and by aircraft.

The whole exercise showed that there were at least 100,000 hectares of good exploitable forest, with a minimum annual yield of about 450,000 cubic meters. There was, therefore, a safety margin of 120,000 cubic meters over the required minimum annual cut, which was considered sufficient to justify the whole project as practicable, after taking into account the domestic needs of the local people.

Other results of the survey were:

1. The already existing triangulation points were marked and, taking them as the bases for further triangulation, it was possible to decide which were the other points to be determined and to plan this supplementary triangulation.
2. A firm contract was drawn up with a commercial firm to carry out the aerial survey work, detailing the area to be covered, scale and type of photographs, and flying height.
3. The principal routes that could subsequently be used for carrying out the triangulation and forest sampling were ascertained and a sketch map of the forest areas was made. A rough estimate could be made of the extraction and delivery costs of the raw materials to be supplied to the selected mill site.
4. It was possible to determine fairly accurately the nature of the raw material supply in terms of species, diameter and length of logs or billets. Samples of the various species and diameter-classes were taken and tested as to which methods should be used for the production of newsprint.
5. The requirements in staff for a detailed inventory were ascertained (engineers, draftsmen, chiefs of sampling teams, workmen, drivers).

The data obtained, together with cost estimates and equipment requirements, were submitted to the *Nacional Financiera* and approved at the beginning of 1954.

Second Stage: Forest Mapping

Ground survey

To prepare a forest map a certain number of triangulation points must first be available. Within the area surveyed there were already two such points fully determined and located by the Mexican Geographical Service; the whole triangulation of the area was based on them. Altogether 24 control points were determined, so that the average distance between two neighboring points was about 20 to 25 kilometers, which entailed working at night with a Wild T2 theodolite and luminous signals.

Despite the distance between the triangulation points, it was possible to verify that the forest map was sufficiently accurate for the use that was to be made of it by comparing the resultant map with a topographical survey made independently.

Aerial photographs

Aerial photographs were taken almost at the same time by a specialized Mexican company. The camera used was a Wild RC5a with a 21-centimeter focusing lens. The size of the photographs was 18×18 centimeters and the average scale 1 : 15,000.

Preparation of the skeleton map: mechanical triangulation

The ground control points, that is the 24 triangulation points, were plotted at 1 : 15,000 on a sheet of white drawing paper fixed on a plywood table. For preparing the map a rectangular projection system was adopted, by taking as the axis of co-ordinates the meridian 102° 00' 00" longitude and the parallel 19° 30' 00" latitude which passed almost through the middle of the forest area and, as the contact point of the plane of projection with the earth, the center of these co-ordinates. In this way, any point of the area was fully defined by its co-ordinates. For practical reasons, the area was divided from the start into rectangles of 8×16 kilometers on the terrain, which served as a basis for the map sheets, the size of which, in view of the scale, was 53.33×106.66 centimeters.

The next phase was to carry out the mechanical triangulation, so called because it is done automatically by means of slotted templates which can be set like a star around the center of each photograph (see Figure 2). By joining the stars formed on each photograph a semi-articulated metal network is made. These points represent the projection of the ground points located in the photographs and through which the templates pass. In each photograph, the center of the photograph and that of the adjacent photographs (called the main points) are located, as are also four points called auxiliary suitably situated. An example of the skeleton map is shown in Figure 3.

Interpretation of photographs

We will now deal with the photographs on which were marked, before the mechanical triangulation, the geodesic triangulation points, the main points and the auxiliary points just mentioned. These photographs were then studied with the aid of a mirror stereoscope (Figure 4), the boundaries between the forest areas and the nonforest areas being marked on them. Within the forest areas the boundaries between the cleared

FIGURE 3. – *Connecting the template "stars" in order to form the skeleton map.*

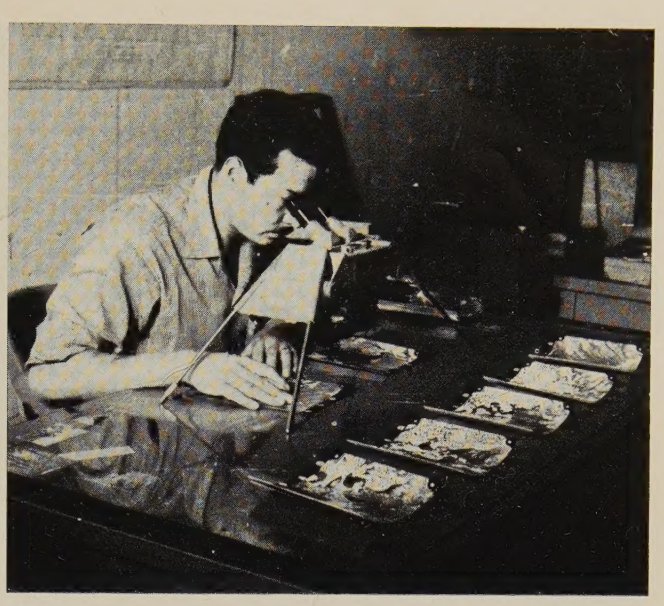


FIGURE 4. – *Interpreting the aerial photographs by means of the stereoscope, using magnifying binoculars if necessary.*

and still wooded areas were marked. Finally division into strata was carried out. The limits of each stratum were marked with a soft pencil so that the mark could be easily erased with a very soft rubber without damaging the photograph. All the strata with areas of over 2 hectares that could be recognized in the photographs were delimited. The stereogram gives an example of this classification (see Figure 5). The whole of the interpretation work was entrusted to one person, so that the bias of error should be the same. What we required of our classification was not so much to have an absolute but rather a relative value since its purpose was to divide the forest into homogeneous parts, that is within which the variations and, consequently, the intensity of sampling are slighter than in the whole of the nonstratified forest.

Transfer to map of details recognized in photographs

All the details indicated by interpretation of the photographs and also the usual cartographic details (rivers, villages, roads, springs, etc.) were transferred to the skeleton map. A multiscope was used to make the three points on the skeleton map coincide in the eye or mind of the operator with the same three points of the photograph to be transferred; it allows for seeing the details stereoscopically, thus automatically correcting the displacement of points brought about by differences in altitude. In this way, we obtained for the whole of the area a preliminary planimetric forest map.

THIRD STAGE: SAMPLING GROUND SURVEY OF THE FOREST AND PREPARATION OF THE DEFINITIVE MAP

Organization of sampling

On the basis of the preliminary map thus prepared and of more thorough reconnaissance surveys of the area the forests were then divided into 12 natural zones that were subsequently to become management series. This division was based on the topographical and ecological features of the zone as is usual in establishing management series: the area of each series was from 15,000 to 25,000 hectares.

The next step was to make a sampling survey of each zone. Random sampling was used with a few variants justified by practical considerations, as will be seen below. The sampling rate was 2 percent; after calculating the accuracy of the sampling for each zone, it was necessary only in the case of the two smallest and most heterogeneous zones to increase the intensity to 5 percent. The sampling units were rectangular plots measuring 20×60 meters.

Plot dimensions in multiples of 20 meters were chosen to permit use of a flexible steel chain 20 meters long plus a 10-meter extension, one length of the chain measuring the width of each plot and 3 lengths for its length. On rough terrain, the operator could either chain by projection or estimate the slope of the terrain, using a clinometer for checking and correcting the length of the chain by using knots fixed on the extension portion, each knot corresponding to a 5 percent step of ground slope.

The locating of the rectangular plots on the ground was carried out independently of the operator. A transparent cross-ruled paper, such as that shown in Figure 6, consisting of two groups of parallel lines was placed on the map for each series. The direction of the lines of the first group was perpendicular to the direction of the lines of the second.

The lines of the first group (horizontal in the diagram) were 1.33 millimeters equidistant on the square-ruled paper and consequently $1.36 \times 15{,}000 = 20$ meters on the terrain, while the equidistance of the lines of the second group was three times greater.

Before placing the square-ruled paper over the map, and considering the terrain to be covered, the direction to be followed by the teams charged with the

Key to Strata

NF.	*Forest lands.*
F 1.	*Lands formerly occupied by forest but now used for farming after clearings were made.*
F 2.	*Grazing areas.*
Qp-I-I.	*Mixed forest of pine and oak in which oak is the dominant species. The density of stocking of the forest is low and the average tree height between 10 and 20 meters.*
Qp-II-2.	*Similar to the preceding type but with medium density of stocking, the tree height ranging from 20 to 30 meters.*
Pq.III-2.	*Pine is the most abundant species mixed with oak. Density is medium and the tree height ranges from 20 to 30 meters.*
PAQ-III-2.	*Pine, fir and oak are the species mixed in almost equal proportions. There is medium stocking and the tree height ranges from 20 to 30 meters.*
R	*These small-sized strata are completely covered by a young growth of pine and some fir.*

FIGURE 5. – *Stereogram of the Pilon mountain, Zone 4, illustrating the interpretation of aerial photographs for forestry purposes. To see it in the third dimension a pocket stereoscope of the Fairchild Model 271 type should be used. The lower part of the stereogram exposed to the North is covered by a denser and higher growing stock than in the upper part of the stereogram. Where there is a southern exposure, the forest is subject to the influence of the hot, dry winds coming from the lower tropical levels. The northern slopes bear fir whereas the southern slopes have only pine and oak.*

carrying out of the survey was chosen. This was always either north-south or east-west (or inversely). The square-ruled paper was then placed over the map but in such a way that the direction of the lines of the first group coincided with the chosen direction. The lines of both groups were then numbered and lots were drawn twice. The first drawing was made within the lines of the first group and 14 lines out of 100 (100 lines of the first group represent 2 kilometers on the terrain) were drawn, using ordinary lotto balls.

It was supposed that the lines numbered 2, 6 and 12 (marked with a thicker stroke) came out on Figure 6; then each line of the first group was considered individually and, for each line, 14 lines out of 100 (100 lines of the second group are equivalent to 60×100 meters = 6 kilometers on the terrain) were drawn by lot within the lines of the second group that cross it at right angles.

On Figure 6, it was assumed that, along line number 6 of the first group, lines numbered 3, 9, 13 and 14 of the second group came out. We then adopted as the south-west angles or corners of the plots situated on line number 6 of the first group, the points of intersection of that line with the lines numbered 3, 9, 13 and 14 of the second group drawn by lot. The rectangular plot was indicated on the diagram by means of hachures. This procedure was used for all the other lines of the first group which gave the square-ruled paper the appearance which it has in Figure 7, on which the forest map has also been drawn. This system of selecting plots, which is rather complicated to explain but can be carried out very rapidly, was adopted be-

cause it allows an almost fixed number of plots (7 on 3 kilometers of coverage) to be concentrated on the same line covered by the survey team, thus doing away with the need for the latter to change its direction. If the plots had been arranged without a certain amount of grouping, there would have been a likelihood of many errors in orientation and plot location.

Thus for a rectangle of 2×6 kilometers, that is 1,200 hectares, $14 \times 14 = 196$ plots of 20×60 meters $= 0.12$ hectares were delimited, the total area of which was $196 \times 0.12 = 23.52$ hectares, that is exactly 1.96 percent of the forest or approximately 2 percent.

Location of the samples on the map and in the field

The square-ruled paper was placed over the preliminary map and the corners of each rectangle marked on it. To find the plots on the terrain easily and quickly it was sufficient to retransfer to the photographs only an easily recognizable single point of each line obtained from the first drawing of lots. If no easily recognizable point, such as a characteristic tree, a house, the angle of a road or field, was found on this line, a nearby point was located, connected with the point itself by azimuth and distance. These were called starting points.

For practical purposes, the lines were grouped in blocks measuring 2.5×3 kilometers. The distance of 3 kilometers was in fact the distance that a team could cover in a single day in surveying 7 plots on a single line of the first group (first drawing of lots). The survey teams were therefore provided with photographs showing the starting points of each line of plots, as well as with the survey diagram on scale paper where the position of the survey plots was indicated in relation to the starting point. An example is given in Figure 8.

As all the distances were multiples of 20 meters and all the azimuths corresponded to one of the cardinal points, errors were reduced to a minimum (Figures 8 and 10 illustrate some aspects of this work).

A sufficient number of trees were felled in order to compile volume tables. These were double-entry tables but the heights were grouped only in three categories counted in tens of meters, in concordance with the photo-interpretation by stereoscope. This estimate was afterwards checked with the findings entered on the survey sheets (Figure 11).

Grouping samples by strata: preparing a definitive map

It has already been stated that strata had been drawn on the preliminary map. As each plot could be located on the map simply by placing the transparent square-ruled paper over it, it was possible to ascertain to which stratum of the map each surveyed plot belonged. The plots were accordingly grouped by strata. After the plots had been grouped it was also possible to check the interpretation made with the aid of the stereoscope and to correct the preliminary map, which then became the definitive map.

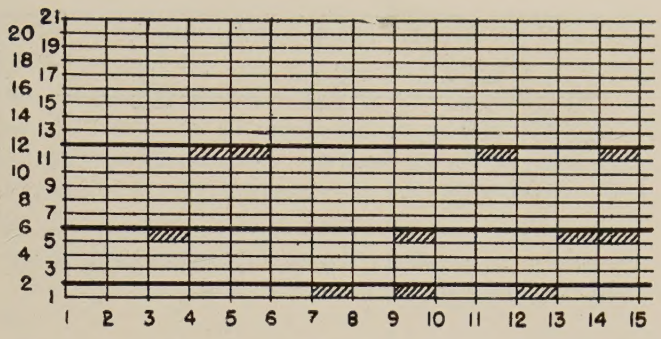


FIGURE 6. – *A transparent cross-ruled paper consisting of two groups of parallel lines placed on the map for each series.*

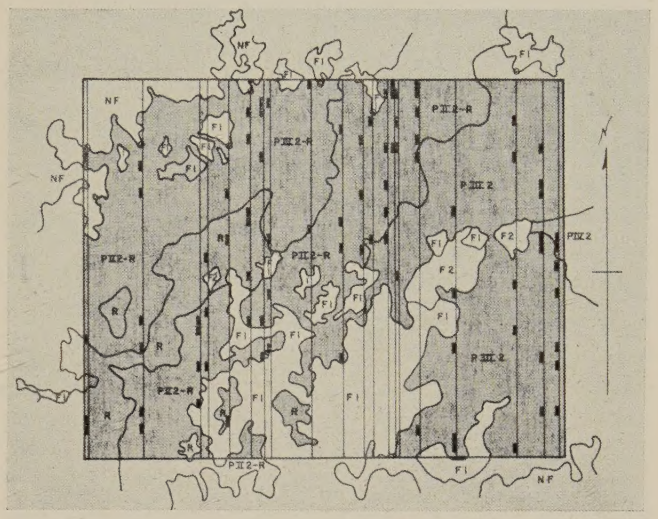


FIGURE 7. – *Distribution of the sampling units on the rough sketch of the forest map. The units that happened to be in nonforested places were eliminated. Scale 1: 30,000*

FINAL STAGE: UTILIZATION OF THE FIELD MEASUREMENTS

Determination of the average hectare of each stratum

The total volume of each botanical genus, was estimated separately for each plot. By working out the arithmetical average of these findings, an initial estimate of the average volume (by botanical genus and stratum) of the plots was obtained. Then the average number of trees per plot was determined for each stratum, genus and diameter-class (in 5 centimeter categories). Thus, a second method for estimating average volume per plot was obtained.

Multiplication of the result by the factor $\frac{1}{0.12}$ (since the area of a plot was 0.12 hectares) gave the average volume per hectare.

The same procedure was used for the average number of trees per hectare and per diameter-class.

Increment

Many samplings were made with a Pressler increment borer during the inventory of each plot. The samplings were also grouped by strata and the average number of years taken to pass from one diameter-class to the next

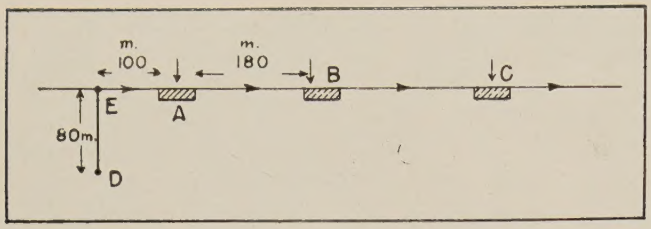


FIGURE 8. – *Diagram of survey.* D *is the starting point while* E *indicates the line of the plots.*

FIGURE 9. – *Location of sampling unit by compass and chaining.*

FIGURE 10. – *On reaching the sample plot, a metal plate showing the number of the plot is nailed on the nearest tree.*

was determined. The increment on the average hectare was determined for each diameter-class and then for all trees on this average hectare by standard methods.

Projection of average values to the series as a whole

The area of each stratum was determined by the use of a planimeter and it was multiplied by the figures obtained for the average hectare, such as total volume per hectare, or per diameter-class for a single botanical genus, number of trees, increment, etc. In some cases, certain strata were not sampled on account of their small areas but, by comparison with similar strata belonging to other series of the forest zone or to comparable strata of the same series, they were assigned certain volumes and composition per hectare: in fact these presumed volumes were never more than 5 percent of the total volume of the series investigated: any error was therefore negligible.

Calculation of error

The error per stratum was computed by standard methods of statistical calculation (computing standard deviation, standard error of the average and sampling error).

Then the error in estimating the volume of the whole series was calculated. An error for the whole area of over $\pm$ 5 percent was found only in the case of the two smallest and most heterogeneous zones, and it sufficed to carry out a 3 percent supplementary survey to obtain the desired accuracy. All the sampling errors computed were calculated for a probability of 0.05. Besides

FIGURE 11. – *Measuring the average height of the stand. This measurement is subsequently compared with the interpretation (already carried out) of the photographs by means of the stereoscope.*

these sampling errors, there are the usual errors in the physical surveying: errors of measurement, errors due to the volume-tables, etc.

Cadastral map

In preparing an accurate cadastral map of the forest lands comprised in the scheme, the aerial photographs again proved very useful. A particular team leader inspected all forest holdings on the ground and marked the boundaries of each on the photographs, where they were almost always easily recognizable. He recorded the fairly numerous instances of contested ownership. The boundaries of the holdings as seen in the photographs were transferred to the map by means of the multiscope.

Finally, to estimate the growing stock on each holding, the area of each stratum contained in the particular holding was measured on the map and the areas thus obtained were multiplied by the average volume per hectare of each stratum determined as already described. The sum of the volumes of all the strata contained in each holding was taken to be the total growing stock. A similar calculation was made in regard to increment. Obviously the smaller the holding, the less accurate are the results so obtained.

Without aerial photographs, such a cadastral map of forest lands and the estimation of the growing station of each holding would have been far more costly and taken much longer to carry out.

Drafting of the inventory report

For each series, the results of the survey were written up in a report to which were annexed the forest maps and the cadastral map of forest lands. The total volume of the series per botanic genus and per stratum were given and also the area of each stratum, the composition by diameter-classes and by stratum, etc. All the results that could be expressed graphically were given in that form in annexes. On the basis of such extremely detailed information presented in a ready reference form, the management plan for each series could subsequently be rapidly compiled.

The following is a brief summary of the inventory data:

	hectares
Area covered by aerial photography:	558,000
Area not under forest:[1]	241,000
Actual forest area:	317,000
Clearings within forest:	45,000
Area covered by trees:	272,000
of which:	
a) Pure broadleaved type of little economic interest:	22,000
b) Mixed conifers and broadleaved forest:	250,000

Volume of standing timber on these 250,000 hectares:

		cubic meters
a)	Pine (90 percent): Fir (10 percent):	25,000,000
b)	Oak (85 percent) : Alder (15 percent):	500,000

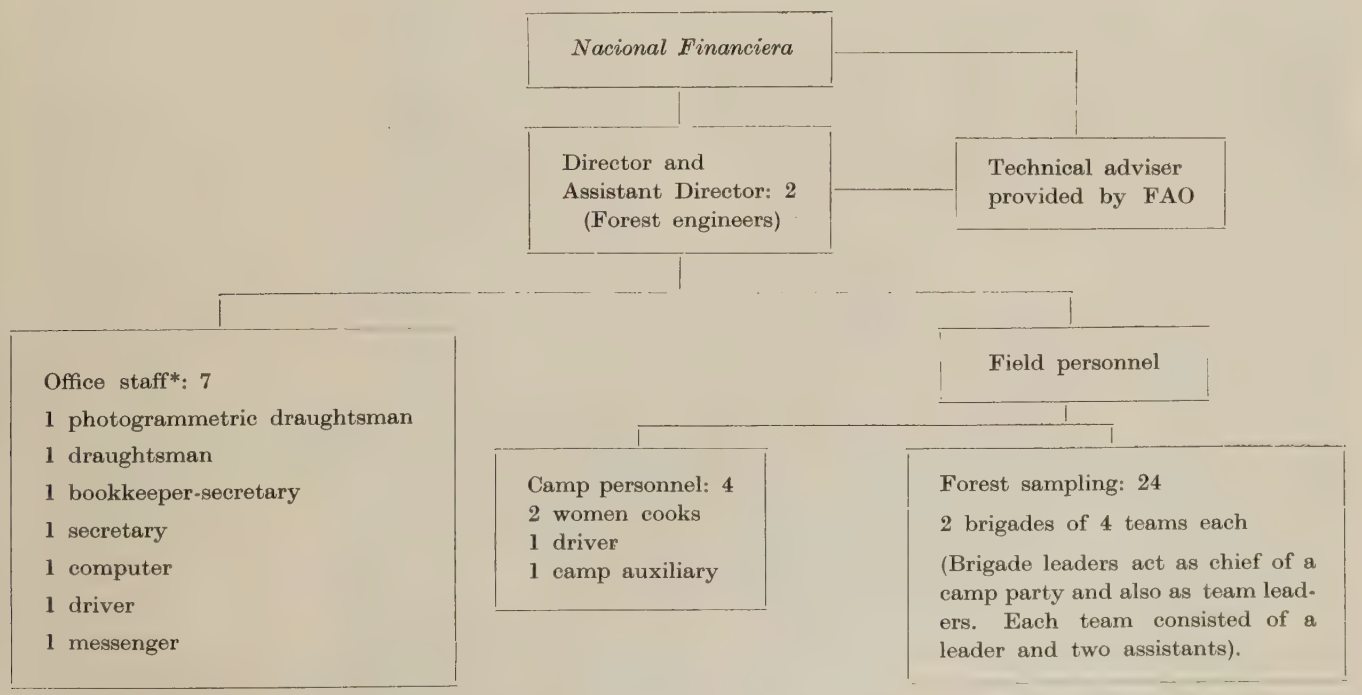
Gross annual increment

Conifers	1,000,000
Broadleaved:	50,000

Average annual rate of increment of conifers: 4 percent.

[1] Includes 227,600 hectares of farm land or pastures, 9,000 hectares under volcanic lava due to a recent volcanic eruption, 2,900 hectares occupied by villages or other habitations, and 1,500 hectares of lakes or dams.

FOREST INVENTORY OF CELULOSA MICHOACÁN ADMINISTRATIVE ORGANIZATION



Total personnel: 37 persons.
* At the end of the survey the brigade or team leaders were used in the office for the difficult work of area calculation.

Organization and Cost of the Inventory

The diagram shows the organizational structure at maximum staffing. Brigade and team leaders were chosen from among young men aged 18 to 25 years who had had practically no training in forestry but a secondary education and a sturdy physique. It was necessary to train them completely in the use of the compass, the chain, recognition of tree species (12 species of pine), the use of the Pressler increment borer, and so forth. After a kind of probationary period of four to five months during which almost two out of three of the trainees were eliminated, it was possible to produce an energetic and enthusiastic team of two brigade leaders, six team leaders, and assistants.

When work in the field was under way, it was possible to set the daily work norm for each type of terrain (for example, seven plots on average terrain), and to increase efficiency a bonus was awarded for each plot measured over and above the norm. To guard against the risk of quality being sacrificed to quantity, one of the forest engineers or one of the brigade leaders made periodic spot checks of the measurements recorded for completed plots.

The total cost of the inventory worked out at US$ 92,000. The cost per square kilometer was as follows:

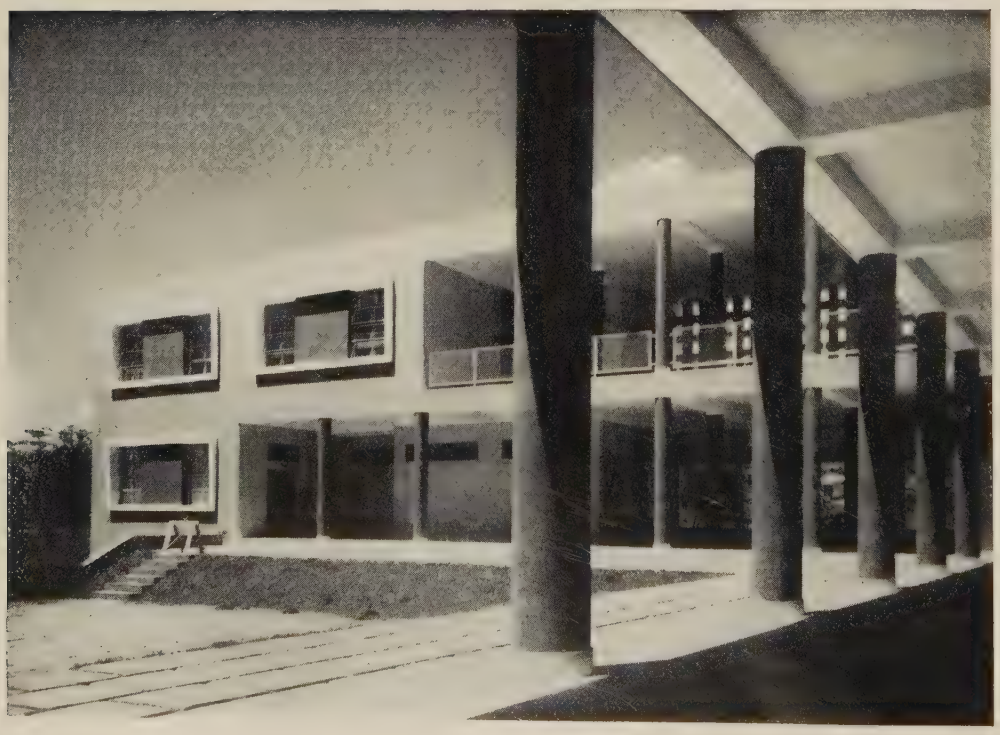
	$
Taking of photographs	2.80
Preparation of map	6.40
Sampling in the field	6.40
Office work and drafting of the survey report	4.00
Administration expenses	2.40

The first two figures relate to the total photographed area of 558,000 hectares, while the last three figures relate only to the forest area of 317,000 hectares. The average cost per square kilometer under forest was therefore $29.00 and per photographed square kilometer (57 percent under forest) $16.50.

This was an intensive survey carried out not only for the purpose of acquiring a general knowledge of the resources of a region but also with a view to providing the basis for subsequent management and utilization plans. This kind of survey is always the most expensive.

If the cost of the inventory is related to an annual cut of 750,000 cubic meters of softwoods (about 75 percent of the increment) and if it is desired to pay off the costs of the survey in 10 years, the cost per cubic meter of field is $\frac{92{,}000}{750{,}000 \times 10} = \$1.25$ cents, which is a low figure, even if interest is added, in comparison with the stumpage rate of timber in Mexico which is itself low, averaging approximately U.S. $2 per cubic meter (sawtimber and pulpwood).

Translated from an original French text



New buildings of the Latin-American Forest Research Institute, attached to the University of the Andes (Forestry Faculty) at Mérida, Venezuela. A note on the Institute appears on page 88.

Courtesy: Fotoediciones "La Casa del Turista" Mérida

Forestry in the Soviet Union

Developments over the Past 40 Years

P. V. Vasiliev
Deputy-Director of the Institute of Forestry, Soviet Academy of Sciences

Of all countries, the Soviet Union has the most extensive forested area. But it is not for this reason alone that foresters throughout the world have the highest interest in our forestry. It is rather because of the originality and special nature of its development, especially during the past 40 years, when it began to be conducted entirely on the basis of State ownership of forests.

Both the general practical lines of development of forestry and the scale of the various forestry projects in the U.S.S.R. have been determined in the past 40 years, first and foremost, by the importance of forests as a source of raw materials for industry and, consequently, by advances in the main branches of the wood treatment and processing industries of our country and the supplying of timber for them. The growth of these branches of production is shown in Table 1.[1]

Table 1.– Growth of Output of Wood and the Main Wood Processing Industries

Industries	1913	1928	1940	1956
Output of:	.....*in million cubic meters*			
Fuelwood	36.5	25.7	128.2	120.0
Industrial wood	30.5	36.0	117.9	219.5
Production of:				
Saw timber	14.2	13.6	34.8	[a]70.0
	....*in thousand cubic meters*....			
Plywood	203.5	185.0	731.9	[a]1 100.0
Paper	269.2	284.0	812.0	1 993.0

[a] For 1955.

Besides the extraction of timber and the widely organized utilization of the forest for water conservation and protective purposes, the State and the population have obtained from our forests huge quantities of fodder, food and technical by-products, furs, etc. The annual income from forestry in terms of money amounts to over 1,000 million roubles, not counting the value of by-products supplied free of charge and the value of pelts, which in some years have provided the country with up to 15 percent of its total foreign exchange receipts from exports.[2]

Forestry, lumbering and the wood treatment and processing industries in our country constitute the daily employment of a huge army of people. At present, about 500,000 workers are directly employed in forestry, no less than 2 million in lumbering and over 600,000 in the wood treatment and processing industries, i.e., altogether approximately 3,100,000 men, or 6 percent of the total number (52 million) of workers and employees in the country. Of the industrial workers, however, those in the timber conversion and the wood treatment and processing industries alone amounted to 15 percent in 1955.[2]

During the postwar years, the technical equipment of the lumbering industry has been greatly expanded and improved and much work has been done to bring into use the almost inaccessible large forests in the northern regions of the European part of the country, those in the northern Urals, and the taiga[3] of western and eastern Siberia and the Far East. The rate of logging in the European north increased from 5.3 percent in 1913 to 13 percent by the end of the fifth Five-Year Plan; in the Urals, from 9.8 to 20 percent; in the regions of western Siberia, eastern Siberia and the Far East, taken together, from 8 to 30 percent.[2]

Spearheaded by the lumbering industry, there have appeared in the formerly inaccessible taiga[3] regions, roads, settlements, schools and clubs, while local industries are springing up and farming is being started.

Principal developments

The growing timber requirements of the country are being met to an ever-increasing extent through the opening up of remote forests in the central, western and southern regions of the European part of the country. It has, therefore, been possible in the last 40 years to halt an intensive process of forest destruction

[1] From the statistical volumes, *Industry of the U.S.S.R.* and *National Economy of the U.S.S.R.*, Gosstatizdat, Moscow 1957. Data for 1913 for the territory within the contemporary frontiers of the U.S.S.R.

[2] See *Lyesnoe Khozyaistvo* (Forestry) No. 4 for 1957, page 5.

[3] The coniferous forests in the far northern regions of Eurasia.

that had been going on for two centuries in most of the sparsely-wooded regions. In this connexion, Table 2 merits close attention.[4]

TABLE 2. – CHANGES IN THE PROPORTION OF FORESTED AREAS IN THE EUROPEAN PART OF RUSSIA OVER THE PAST 260 YEARS

Areas	Percent of forested area for the years				
	1696	1796	1868	1914	1956
Territories of 7 Regions around Moscow (Vladimir, Kaluga, Moscow, Ryazan, Smolensk, Tver [Kalinin], Tula):	53.2	41.6	31.0	22.2	22.2
Tambov and Penza regions	46.1	32.6	24.0	16.2	14.5
Middle Volga regions (Simbirsk [Ulyanovsk], Samara [Kuibyshev], Saratov):	18.0	15.4	15.3	12.1	12.5
Baltic regions (now Republics):	36.1	36.1	31.7	23.5	19.0

Increased logging meant, in the first place, that extensive measures had to be taken for the study and management of the stands in the newly worked, thickly forested regions. But, in the course of this study, it became evident that Soviet Russia had considerably more forests than was estimated, both in 1914 and in the 'twenties and 'thirties under the Soviet regime. Thus, whereas in 1914 the forested area of Tzarist Russia was reckoned at approximately 570 million hectares[5], by 1937, as a result of inventory corrections, this figure was increased to 628 million hectares[6], while according to the data available on 1 January 1956 it comprises 681 million hectares, even without reckoning the collective farm forests. Estimates of the growing stock of timber have risen from 45,000 million cubic meters, according to 1937 calculations, to 78,000 million cubic meters, according to the latest data.

However, the main bulk of the forest resources of the country, including those newly come to light, are still as before, in the regions of the north and of the Asiatic part of the country, remote from the centers of economic life. As a result of the efforts to supply the central provinces and the sparsely wooded regions of the south with timber from the remote, well-forested regions, timber transport by rail is being rapidly extended over greater distances. Average transport distances throughout the country rose from 415 kilometers in 1913 to 1,293 kilometers in 1956. An excessive increase in transport distances and in the volume of the timber conveyed causes an economically unjustifiable rise in the cost of timber at the place of consumption. If one takes into account that, according to present forecasts, timber consumption throughout the country is expected to increase, even discounting possible economies, to no less than 450 million cubic meters by 1975, then the unfavorable consequences of a further increase in the distances timber is transported can easily be imagined. Hence, of late years, side by side with the problems involved in putting more and more forests of the well-wooded regions to industrial use, there has arisen with no less urgency the problem of definitely increasing the forest stocks in the central provinces, in the west and south. This is to be effected by afforestation of all suitable but, for various reasons, unproductive lands of the State forest reserves, and by a broad scheme of measures for increasing the stand yields (introduction of fast-growing species, land drainage, restocking of low-grade coppice, etc.). Only in the course of the sixth Five-Year Plan was provision made to plant up to 3,000,000 hectares of forest with economically valuable and fast-growing species, mainly in the poorly wooded areas of the European part of the country. In carrying out this task, the experience of the foresters of Austria, Czechoslovakia, Germany, Italy and other countries has been very useful to the U.S.S.R. The sixth Five-Year Plan also provides for projects promoting natural regeneration on an area of 3,800,000 hectares and in establishing over 800,000 hectares of protective forests.

Such projects ensure an increase of forest resources on a wide scale in the central, western and southern regions, as can readily be seen from the following data. In 1955, the felling area in the Volga region comprised 28,400 hectares, while the area reserved for natural and artificial regeneration comprised 34,300 hectares, or 121 percent. The area of regenerated forest in the northern Caucasus exceeded the felling area by 25 percent; in the western region, including the Baltic Republics and the Byelorussian S.S.R., by 34.5 percent; in the southern region by 181 percent. The situation was approximately the same in 1953 and 1954. It is easy to see how profoundly these indices differentiate the Soviet economy from that of the prerevolutionary period.[7]

In recent years, altogether 700,000 to 800,000 hectares of new forests for various purposes have been planted annually in the U.S.S.R. on the lands of the State forest reserves, whereas in prerevolutionary Russia the number of hectares planted in the Crown forests

[4] Data for 1696-1914 taken from M. A. Tzvyetkov's book *Changes in the Rate of Forestation of European Russia from the End of the XVII Century to 1914*, published by U.S.S.R. Academy of Sciences, 1957, and for the year 1956 according to the data of the latest estimate of forest resources. As there is some difference in the frontiers of the compared territories for 1914 and 1956, the given index must be considered approximate.

[5] M. I. Ivanovsky, *Essays on the Economic Geography of the Forest*, State Publishing House, 1926.

[6] See volume 50 entitled *U.S.S.R.*, of *The Great Soviet Encyclopaedia, 1957*.

[7] Data for 1953-1954: see *Lyesnoe Khozyaistvo*, No. 5 for 1956, page 56.

during the whole period of the development of silviculture was only slightly higher, altogether 891,000 hectares.

The dynamics of the growth of the work of forest planting is very significant. In the years 1921 to 1928, 410,000 hectares were planted; during the first Five-Year Plan, 534,000 hectares; during the second Five-Year Plan, 684,000 hectares; during the three years of the third Five-Year Plan, 964,000 hectares; during the fourth Five-Year Plan, 1,716,000 hectares. Moreover silvicultural work embraces up to 800,000 hectares annually as compared with 50,000 to 60,000 hectares in the State forests of Tzarist Russia. Large-scale projects are in hand for guarding forests against fires and protecting them from disease and pests, for both of which purposes, as well as for carrying out forest inventories, aircraft are now being widely used. Nevertheless, success in guarding and protecting the forests is still far from satisfying either the foresters themselves or the public, representatives of which have recently repeatedly expressed their views in this regard in the form of critical articles.

Organizational structure of forestry

In the U.S.S.R., the logging and distribution of timber from the State forests are centralized under a single economic plan. Recently, in connexion with the reform of industrial management, as in the case of other industries, a start has been made to put forest industries under the direct administration of the newly-created local centers of the Soviet national economy. The forest resources of the State forest reserves, however, remain as before under the central authority of the forestry agencies of the Ministries of Agriculture of the U.S.S.R. and of individual Union Republics. This organization of the country's forestry ensures that both national and local interests in forest utilization and production are taken into account.

To meet local requirements and, especially, those of the collective farms and the rural population (apart from the sale to them of timber from the State lumbering industry and from logging carried out by local authorities) special timber resources, namely, the collective farm forests, are allotted throughout the U.S.S.R. These stands, formally and in principle assigned by the State to the collective farms for their perpetual use, in many regions comprise 20 to 25 percent of the total forested area. It is characteristic that, in many poorly wooded regions, the collective farm forests cover a much greater proportion of the total forested area than was formerly taken up by the peasants' forests. Thus, in the central regions, in 1913, the combined area of peasant's forests was 6.5 percent of the total forest area, whereas now the collective farm forests comprise 19 percent. In the south of the European sector of the country, the proportion of such forests rose from 13.6 to 19.5 percent and in the western region from nil to 26.2 percent.

Although, in recent years, wood supplied from the State forests has had to be paid for, most of the by-products are free. This contributes in no small measures to increasing the prosperity of the inhabitants of the forest regions.

Succession of species: birch with advanced growth of spruce. Danilovsky leskhoz, Yaroslavl Region.

Research and training

Outstanding successes have been achieved during the last 40 years in developing scientific research in forestry and in the sphere of training the necessary technical personnel.

In prerevolutionary Russia, only two university-level institutions trained foresters, whereas at present there are 11 university-level specialized forestry institutions and several schools of forestry in the universities as well as in polytechnic schools and agricultural institutes in the U.S.S.R. There are also 26 secondary technical schools of forestry and 19 schools that give one-year courses. Altogether, 10,000 students are studying in various specialized fields of forestry, while 12,000 young people are being trained in technical schools.

Over 12,000 engineers, 22,000 technicians and 45,000 junior foresters hold responsible forestry positions. Recently, it has been decided to appoint technician-foresters with specialized training instead of forest rangers.

Research on problems of forestry as a science, which was mainly done in the past only at university-level forestry institutes and at eight experiment stations, is more recently being conducted by a number of specialized forestry institutes and departments in the network of the Academy of Sciences of the U.S.S.R. and its branches, as well as by the Academies of Sciences of the Union Republics, the Forestry Department of VASKHNIL and eight research institutes of the Ministries of Agriculture of the Union, the Russian Socialist Federal Soviet Republic, the Ukrainian Soviet Socialist Republic and others, and a large number of forest experiment farms (*leskhozes*) and stations in various parts of the U.S.S.R. The number of workers in forestry research has increased tenfold in the past 40 years.

The future

Naturally, forestry in the Soviet Union owes a considerable part of its success to the results of the work of these people and institutions.

It would, of course, be wrong to think that the present level of our forestry ensures a scientific and full-scale utilization of all the resources and values that are created and can be created in the forests of the country. In many regions, especially in the north and in the Asiatic part of the country, forestry is still at a low level. There are many shortcomings both in the organization of logging and in the whole forest industry. The elimination of such defects is one of the important tasks of the daily work not only of the various units of the Soviet Forest Service but also of all organs of the Government, national and local. For this reason at the present time the Soviet people, and in particular the forestry workers, noting with satisfaction the successes achieved in the past 40 years, continue with undiminished zeal to criticize the backward sectors and aspects of their forestry, so that by overcoming the shortcomings, they may go forward to new successes.

Article translated from an original Russian text

THE LOWER MEKONG RIVER: *A major United Nations project over the next five years will be to investigate and plan for the comprehensive development of the four-nation watershed of the Lower Mekong River. Thailand, Viet-Nam, Laos and Cambodia will be affected by the projected work, which includes the development of forest industries.*

Methods of Forecasting Production from Thinnings

F. C. Hummel
United Kingdom Forestry Commission, London

In countries where there has been afforestation on a large scale, the volume of forest produce available for marketing will increase rapidly and will change in quality. In particular, thinnings will yield large quantities of small-sized produce for which there may be no established markets within easy reach. The establishment of new wood-using industries may be called for, but this needs to be carefully planned if the industries are to flourish while paying an adequate price for the raw material. The right type and size of plant must be selected and it must be put up at the right place and at the right time. This careful planning is only possible if reliable forecasts of production are available.

The object of this paper [1] is to discuss the problem of forecasting thinning production and to show how it is dealt with in Great Britain, where the forestry conditions are somewhat unusual.

Our total forest area is 1,600,000 hectares, or about 7 percent of the total land surface; 400,000 hectares are managed by the State Forest Service while most of the other 1,200,000 hectares are in private ownership. There are but few large tracts of forest and the greater part of our forest area is made up of many small woods which are widely dispersed throughout the country but readily accessible by road. Most of the State forests consist of forest crops less than 40 years old in which conifers predominate. The private woods, on the other hand, contain a large proportion of old stands, mainly broadleaved, and also large areas which are not fully productive as a result of wartime fellings. At present, the State Forest Service plants 20,000 to 25,000 hectares a year, most of which is on land not previously under forest and consists of coniferous species, except in the relatively small areas where growth conditions for broadleaved species are favorable. Private owners, of whom there are about 40,000, are planting between 10,000 and 12,000 hectares per year, mainly on old woodland sites. Technical advice and financial assistance is made available by the State which, however, exercises some control over the level of fellings.

In both State and private planting the most common species are Scots pine, Corsican pine, Sitka spruce, Norway spruce, Japanese larch, European larch and Douglas fir, but several other species such as *Tsuga heterophylla*, *Abies grandis* and *Pinus contorta* are gaining in popularity.

Methods of approach to the problem

Generally speaking, there are three broad approaches to the preparation of production forecasts in forestry.

First, there is the felling plan which consists of a program by which a certain volume of produce is felled each year. These volumes may be arrived at after considering the requirements of industries, silvicultural and other relevant factors, but the essential feature is that the actual volume that is to be felled is definitely prescribed. For a country as a whole, this approach is only possible if the economy is strictly controlled. The Soviet Union has prepared production forecasts of this type.

The second possible approach is to forecast consumer demand. A forecast of this type, which takes into consideration such factors as probable changes in the size of population, in the standard of living, and of technical developments which may either lead to new uses for wood or to its substitution by other materials, has recently been prepared by the United States. This approach is particularly appropriate where the central forest authority exercises little or no control over the level of felling.

The third approach, which is a primary concern in Great Britain, is to take as the starting point the silvicultural potential; that is, to estimate the volumes that will be felled under a specified silvicultural treatment. The essential difference between this approach and the felling plan is that in this case the silvicultural treatment is prescribed and the yields that result from it are estimated while, in the felling plan, the volumes to be felled are prescribed and the silvicultural treatment may have to be adjusted accordingly.

[1] This article is adapted from a paper entitled "Yield Regulation and Forecasts of Production" which was read at the meeting of the British Association for the Advancement of Science at Dublin in September 1957.

The method used in Great Britain

In order to determine the silvicultural potential of a forest or a whole country it is necessary to have information on:

1. area, volume, and increment (implying a survey of the growing stock);
2. the silvicultural treatment;
3. statistics of past yields.

The collection and assembly of this information is perhaps the most difficult and laborious part of preparing forecasts and must therefore be considered in some detail.

The first of these requirements presents no particular difficulty in either State or private forests provided that permission can be obtained to enter private property to collect the necessary data. Information on future silvicultural treatment and statistics on past yields is, on the other hand, often only available for the State forests. But if the information on the growing stock is collected in the same way in all forests, irrespective of ownership, forecasts for the private woodlands may be made by using the State forests as a standard of comparison and as a guide. For this reason, our national forest survey covers both State and private forests.

Survey of growing stock

Although there were some previous surveys, in the present context the starting point may be considered to be the complete census of all woodlands over 2 hectares in extent which was carried out between 1947 and 1949[2]. The first stage of the work was to visit all woods over 2 hectares and to classify each stand in them according to crop type, age class, tree form, stocking and species. In order to provide adequate estimates of the total areas in each species and age category for the purpose of forecasting yields, a complete census of all woods was not necessary; a survey of a suitably selected 5 to 10 percent sample of the total area would have sufficed. The complete census was, however, carried out in order to implement the general policy of encouraging efficient forest management on private estates.

The second stage of the work was to provide estimates of volume. No attempt was made to estimate the standing volume of individual stands or even forests, but, for each major region, estimates based on sample enumerations were obtained giving average volume per hectare and total volumes by species and age classes. The sampling units were circular plots of 0.04 hectares and there was one plot for every 80 hectares giving a sampling fraction of 1:2,000. The sample was stratified by county, species and age class, but within each stratum the selection of the stands to be sampled and the allocation of plots within the stands was at random. The method of sampling was designed to give an unbiased estimate of adequate precision at minimum cost and an approximate estimate of that precision. A total of about 7,000 plots was measured.

The third stage was to arrive at an estimate of the current increment. No very precise estimate was considered necessary at the time, as the level of fellings and thinnings for many years to come would not be greatly influenced by the current increment. This is partially due to the very abnormal age class distribution of British forests and partially to the need, immediately after the war, of replenishing the sadly depleted stocks of standing timber by restricting fellings to a minimum irrespective of increment. The estimate of increment was based, not on measurements taken as part of the National Forest Survey, but on the data derived from our long-term studies of growth and yield in the permanent sample plots of the Forestry Commission. In important species, for which insufficient permanent sample plot data were available, subsidiary information on the rate of growth was obtained by means of stem analyses on several hundred trees.

Long-term studies of growth and yield are a field of work in which co-operation between neighboring countries is likely to prove particularly useful. Co-operation leads to economy of effort and it may save time. For example, the results of studies in Great Britain of species such as Sitka spruce should serve as a useful preliminary indication of the growth potential of the young stands of this species in Ireland and as a starting point for more detailed local studies in that country; conversely, foresters in Great Britain should be able to benefit greatly from Irish experience with lodgepole pine.

The census of 1947 - 1949, the cost of which worked out at slightly less than 2s.6d. (U.S. $0.35) per hectare, was followed in 1951 by a sampling survey of the small woods, hedgerow and park trees which, in Great Britain, account for over 20 percent of the total standing timber and form such a characteristic and pleasing feature of the British landscape, particularly in the southern half of the country. A detailed report on the survey and the methods used has been published.[3]

The information on the area and volume of our woods is now being kept up to date by a system of continuous census revision whereby a few counties are resurveyed each year. This revision started in 1953; it embraces hedgerow and park trees as well as the larger woods, State forests as well as privately owned woods. In the State forests, most of the information is available from management records but the information is recorded in exactly the same way as for private woods because this facilitates forecasts of production in the private woods. The methods used in the census revision are very similar to those used in the original census except for some minor refinements and only one of these need be mentioned here.

[2] U.K. Forestry Commission (1952). *Report on the Census of Woodlands 1947-49*, Her Majesty's Stationery Office, London.

[3] U.K. Forestry Commission (1953). *Census Report No. 2 Hedgerow and Park Timber and Woods under Five Acres, 1951*, Her Majesty's Stationery Office, London.

In each plot in which the volume is measured, the portion of that volume which could be removed in thinnings at the time of measuring is recorded. This is intended to assist in determining the thinning potential. The method has not been in use long enough to prove its worth in Great Britain but it has been found useful elsewhere, for example, in Finland, Sweden and Cyprus, and little additional work is involved. The surveyors' judgment of how many and which trees could be removed is necessarily subjective but some uniformity of standards is maintained by the fact that the surveyors all have experience in the measurement and thinning of the permanent research sample plots of the Forestry Commission.

Effects of silvicultural treatment

How, with a given growing stock, will yields be affected by silvicultural treatment? Taking a long-term view, the yield of a forest will equal the increment, and experience has shown that the silvicultural treatment has only a limited effect on total increment although it greatly influences the type and size of produce, the time when it comes on the market and the relative proportion of yield from thinnings and final fellings. It follows that a more accurate knowledge of the proposed silvicultural treatment is needed if forecasts are to relate to thinnings alone instead of to total production and if the forecasts are short term rather than long term. Thinning yields are primarily affected by the grade and frequency of thinnings; and to a lesser extent by the length of rotation.

In areas with large scale afforestation such as Great Britain, total yields from thinnings and fellings may also be greatly affected for a period by measures intended to improve the very abnormal age class distributions that may occur when a whole forest is planted in only a fraction of the intended rotation. The problem of how abnormal age class distributions may be improved with a view to securing a sustained yield has been discussed in two recent papers.[4]

There are five methods by which a transition towards sustained yield may be achieved:

1. grouping, either temporarily or permanently, forests in the same neighborhood to form a single felling series;
2. underplanting or replacing plantations that are unsatisfactory or have failed;
3. taking advantage of the fact that some species grow faster than others and that the rate of growth of any one species will vary according to the site;
4. felling stands before or after they would normally be considered mature;
5. varying the thinning treatment.

FIGURES 1 and 2. – *Considerable quantities of thinnings are now becoming available from woodlands in the United Kingdom. In order to find and establish markets, it is most important to be able to forecast the output for years ahead.* (Above) *Hardwood thinnings being extracted from a private woodland.* (Below) *Removing spruce thinnings from a State plantation.*

Courtesy, Oliver Ltd., London
Fotocraft Co. Chester

It was found that conversion to sustained yield presents no particular technical difficulties and little or no sacrifice in increment provided it is planned in good time and an ample period of conversion is allowed. The main result of the investigation as far as forecasts of production are concerned is that conversion usually entails some heavy thinnings and pre-rotation fellings; this means that a considerable volume of produce may be available for marketing earlier than without conversion.

[4] HUMMEL, F.C. (1956). *A Note on the Improvement of Abnormal Age Class Distribution*, I.U.F.R.O. 56/25/15.
HUMMEL, F.C. and GRAYSON A.J. (1957). *The Achievement of Sustained Yield by Varying Thinning Treatment and Rotation.* Forestry, XXX, no. 2.

Statistics of past yields

While it is possible to prepare forecasts solely from a knowledge of the growing stock and of future treatment, the reliability of any forecast is greatly increased if statistics of actual past yields are available as a guide. Early attention to the collection of felling statistics is, therefore, desirable in any large-scale afforestation scheme, where the yields from the new plantations may be expected to differ considerably from old established forests. In collecting statistics on yield, three points require particular attention.

First, any statistics must be as simple as possible. There is a great temptation, in an endeavor to achieve perfection, to devise too complicated a system of records which it is impracticable to maintain accurately; and inaccurate records may be worse than useless because they mislead.

Secondly, the records must be consistent. Forestry is bedevilled by a multiplicity of units of measurement and conventions of measuring. Timber may be sold by volume or by weight; over bark or under bark; volumes may refer to "gross" volumes of a tree or to "net" volumes of what is regarded as merchantable under particular conditions. Even where these complications are still unavoidable, statistics should all be reduced to one common unit by using suitable conversion factors. In Great Britain, stemwood over bark, measured to a top diameter of 7.5 centimeters (3 inches), has been adopted as the basis for felling records and the volumes are expressed in "hoppus" feet, one hoppus foot being equal to 1.27 true cubic feet or 0.036 cubic meters. The archaic convention of hoppus measure can hardly be justified on rational grounds, but it is so widely used in practice that it was the obvious choice as the standard unit.

Thirdly, as has already been mentioned, it is desirable that the statistics for private woodlands should be comparable with those for the State forests. In Great Britain, all major thinnings and fellings on private estates are licensed by the State, so that adequate records present no difficulty.

The work of forecasting

When the available information on the growing stock, future treatment and past yields has been assembled, the actual work of forecasting can begin.

In Great Britain, it has been found useful, in both State and private forests, to distinguish between long-term forecasts covering periods of about five to 30 years, medium-term forecasts for periods of two to five years and short-term forecasts for the year immediately ahead.

When preparing long-term forecasts for the State forests, the first step is to determine the gross area which is in the thinning stage at the time of the estimate and to calculate what this gross area will be after 5, 10, 15, 20 years and so forth. Within each forest, separate areas are calculated for the major species groups and site types, but it has been our experience that if this differentiation is carried too far, much work may be caused without any corresponding gain in the accuracy of the forecast. In order to arrive at the gross area it is necessary to know the average age at which thinnings commence: under British conditions, this is usually between an age of 15 and 20 years. From the gross areas deductions must be made for areas in "check" (i.e., where abnormally slow growth leads to a delay in the first thinning), as well as for possible losses, e.g., from wind and fire and, where old age classes are present, for final fellings according to the felling plan.

Having determined the net area for each species-site category, the next step is to determine the average annual thinning yield for it. Under British conditions, this usually works out at somewhere between 4 and 7 cubic meters per hectare per year in the case of conifers and rather less than half that amount for broadleaved species. This figure is usually estimated from past records in the forest concerned but, in recently planted forests where no such records are available, the estimate is based either on records from other forests which are comparable or on an estimate of increment from yield tables. Although thinning yields differ somewhat with the age of a crop, it has been found that to work out separate thinning yields for each age class does not appreciably improve the forecasts of total thinning volume although it facilitates a breakdown of this total into size or produce classes. Every five years the long-term forecasts are extended by five years and the forecasts for the intervening period are revised.

The long-term forecasts in private forests are prepared in a similar manner but in less detail. The "gross areas" in the thinnings stage are determined from the census of woodlands but are computed for whole regions and not for individual forests. The necessary deductions for arriving at the "net" areas are estimated from experience in the State forests. The forecast of average annual thinning yield per hectare is based partially on experience in the State forests which indicate the silvicultural potential and partially on records of thinning volumes on private estates which are available because, apart from some minor exceptions, wherever a private owner wishes to thin a plantation he must apply for a license stating the volume to be thinned.

Medium-term forecasts

The medium-term forecasts which cover a two to five year period are in some respects more difficult to prepare than the long-term forecasts because yields may temporarily be either reduced or increased by relatively minor changes in silvicultural fashions or in economic climate. While the long-term production is largely determined by the physical growth potential of a site, the amount that is felled during any short period of years can be varied greatly. Forecasting human behavior thus plays an important part in medium-term and short-term forecasts.

Reliable medium-term forecasts are only possible where there are definite thinning plans such as exist

in all State forests in the United Kingdom and some of the private estates. These thinning plans are based on a thinning cycle which is usually three to four years for young plantations and six to eight years for older ones; they prescribe the area to be thinned each year and also in some instances, the actual compartments in which these thinnings are to take place. It is particularly important to make provision for the areas which reach the stage of first thinning during the period. The area to be thinned is multiplied by the expected volume yield per hectare, which lies normally between 20 and 40 cubic meters. This expected yield per acre is estimated either from past records or from an assessment of each individual stand. Except in special circumstances, estimates based on average past records for the forest as a whole have provided as reliable as more detailed estimates compartment by compartment. For private woodlands, where thinning plans are nonexistent or unknown to the State forest authority, medium-term forecasts are prepared by taking the known yields of the previous year and the first year of the long-term forecast, i.e., five years ahead and interpolating for the years between, making any allowances that may appear desirable for expected changes in markets, e.g., the establishment of new wood using industries, and other relevant factors. Each year the medium-term forecasts are extended by one year and the forecasts for the intervening years are revised.

Short-term forecasts for the year immediately ahead are prepared in great detail. For the State forests they are linked with the program of work compartment by compartment and with the financial estimates for the year. In the private forests, where this is not possible, the results of the preceding year are taken as the starting point and adjusted to allow for expected changes in markets, etc.

Responsibility for preparing thinning forecasts in Great Britain rested originally with the Mensuration Section of the Research Branch; but gradually an increasing amount of this work has been passed to the territorial Conservators of Forests. This trend is likely to continue because the accuracy of locally made forecasts should steadily increase as more information becomes available from local records of management in both State forests and on private estates.

Lessons learnt in Great Britain

The actual methods of forecasting which are in use in Great Britain are unlikely to be applicable unchanged elsewhere where conditions are different, but it may be useful to conclude by mentioning a few general lessons learnt there which may prove of interest to others. Most of these points have either been discussed or at least implied previously in this paper.

1. The best guide to all forecasts is past experience; for this to be available proper records are indispensable. Records of outturn from forests are usually only reliable if they are simple and if the units of measurement (e.g., over bark or under bark) are uniform and clearly defined.
2. It is desirable to keep the broad framework of statistics for State forests and private woodlands on the same basis, so that valid comparisons are possible and the maximum use can be made of the more detailed statistics available in the State forests for predicting yields in the private forests.
3. In long-term forecasts, it is usually best to adopt the analytical approach, i.e., to take whole forests or regions and total volumes as the basic units of estimate and to derive estimates for smaller areas or the volumes in particular species groups or produce classes by a breakdown of the totals. The same applies to medium-term and short-term forecasts where no detailed data or definite thinning plans are available. To oversimplify: if guesswork is necessary, one big guess is likely to be more accurate than the sum total of many little ones — and it is far less work.

The opposite approach of synthesis, i.e., of building up the total estimate compartment by compartment, species by species, and volume category by volume category causes much more work and will only give more reliable forecasts if all the relevant facts and records are available and there is a detailed program of work such as is only practicable for a limited period. Management planning and proper record keeping necessarily precede accurate forecasting.

A Diversity of Forest Types

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Figure 1. – *In the interior of an Avicenia forest at high tide near Tiab.*

Figure 2. – (Below) *The leaves of Avicenias are used as camel fodder. The inhabitants of Qishm island systematically collect the leafy branches by boat, going as far as the canals of the islands in the Persian Gulf between Qishm and the mainland, which are covered with Avicenia forests.*

Figure 3. – (Above) *A mangrove* (Rhizophora mucronata) *growing on the edge of a canal of brackish water.*

Figure 4. – *The coastal plain. Sparse formations of Kaours* (Prosopis spicigera) *between Bander-Abbas and Minab, on sandy alluvium.*

in Iran

FIGURE 5. – *The oases: a palm grove at Hassan-Lengeh.*

FIGURE 7. – (Below) *Wild pistachio tree* (Pistacia mutica) *growing in the mountains.*

FIGURE 6. – (Above) *Junipers* (Juniperus polycarpus) *in the forest of Guiénau on mountains at 2,350 meters.*

FIGURE 8. – *A caravan of 26 camels carrying wood cut in the forest of Guiénau to Bander-Abbas.*

Medicinal Plants from Forest Land in Yugoslavia

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The flora of Yugoslavia is not only rich but also very varied. Many wild aromatic and medicinal plants flourish, especially on the uncultivated and forest land along the Adriatic coast and on the immense Danubian plain. From these Yugoslavia produces large quantities of high grade extracts and drugs, both for home consumption and export.

After the second world war, the rapid process of industrialization demanded an ever-increasing quantity of various aromatic and medicinal drugs of plant origin, spices, condiments and essential oils for the cosmetic, pharmaceutical, health products, food canning and other industries. Exports gained considerable commercial importance and reputation. Now the growing and export of medicinal and similar plants has become an important factor in the Yugoslav national economy.

Whereas earlier there had existed no scientific institution to study, improve and standardize them, a start was made in the summer of 1945 to carry out systematic investigations of the shrubs and plants growing wild on the forest pastures, on the mountains or the vast saline-alkaline steppes, the marshy and flooded land along the Danube, Tisza, Sava, Drava and Morava rivers, on the sand dunes, on the denuded karst and on other barren or unproductive lands. Studies were then made, in co-operation with foresters, of the possibilities of the scientific utilization of the shrubs and plants to be found on forest lands, especially where the forests had been cut down or badly burnt over during the war. This joint work gave very good results, and experiments were made a few years later of using such plants for the conservation of soils threatened by erosion and landslides.

Figure 1. *Studying medicinal plants in the forests of Mount Goc (1,300 meters) in central Serbia at an advanced course for foresters and pharmacy students.*

Trials were made first with thorny, aromatic and medicinal plants that tolerate long periods of drought, great heat, low temperatures and winter frosts; plants that have deep, strong, ramified roots, and that are not generally browsed by livestock. *Rosa canina*, various kinds of *Crataegus*, *Prunus spinosa*, etc., were planted, *Clematis vitalba* and other climbers, *Hyssopus officinalis*, *Salvia officinalis*, *Melissa officinalis* and certain other aromatic, melliferous plants.

The best results were obtained with *Glycyrrhiza glabra* and among herbaceous species *Cynodon dactylon* which has proved the hardiest and most useful in controlling top soil erosion, especially in arid regions.

In arid mountainous areas, livestock are often grazed throughout the year. They trample the soil and tend to destroy all palatable plant cover. To counter erosion started in this way, an experiment was recently begun to encourage the growth of unpalatable plants and, in fact, all the worst kinds of weeds that are avoided by man or beast, such as *Atropa belladonna*, *Veratrum album*, *V. nicrum*, various kinds of *Helleborus*, *Daphne mezereum*, various kinds of *Verbascum*, *Euphorbia*, *Clematis* and *Aconitum*; *Urtica divica*, *Tamus communis*, *Bryonia dioica*, and so on.

Although this may seem rather a strange idea, it must not be forgotten that the usefulness of certain plants is often relative. *Atropa belladonna*, *Aconitum napellus*, *Datura stramonium*, *Hyoscyamus*, *Scopolia* and many other toxic or deadly plants, furnish medicaments or the raw material from which the principal medicines used in classical and modern therapy are made. One of the most serious cereal grain parasites, *Claviceps purpurea*, is now being grown on rye spikes for the production of ergot (*Secale cornutum*). In bread, ergot is a poison, but yields a very important medicament in gynecology and obstetrics. Why is it cultivated? One kilogram of rye yields from 20 to 30 dinars (U.S.$0.05 to $0.08) whereas one kilogram of rye ergot yields from 2,000 to 4,000 dinars (U.S.$10).

The Yugoslav Government has promulgated very strict laws against the destruction of forests. Therefore the cultivation of medicinal plants on forest or range land should not lightly be dismissed. It takes up to a century to grow stands of softwoods or hardwoods to commercial size. On the other hand, to grow medi-

cinal plants takes only from 1 to 5 years, and after they have been gathered, the forest remains unscathed. But it needs good organization to test and grow valuable medicinal plants scientifically in forests.

Organization of field work

Since 1945, the Pharmacognosy Institute of the Pharmacy School of Belgrade University has been organizing scientific excursions for students of the third year course, to study medicinal plants growing wild on forest land, methods of gathering, drying, packing, and preserving them as well as methods of propagating them in natural surroundings and protecting them.

At the end of each school year, an advanced training course is organized for selected students by the Institute for Research on Medicinal Plants, which has laboratories, gardens for cultivating plants and herbs, and many field experiment stations. Divided into teams, the students are given highly scientific studies and complex duties to carry out in various parts of the country.

They gather information on dangerous, irritant, toxic and other plants, as well as on the local people's pharmacy, medicine and veterinary medicine (plant "ethnomedicine") the medicaments used and medicine practised by primitive people remote from towns and civilization. They arrange for the collection of plants by local villagers, usually of the unskilled laborer class. It has to be remembered that there are many toxic and dangerous medicinal plants, especially those that contain alkaloids, heterosides (glucosides) saponins, toxalbumins, etc. There are also some that cause allergies. In general, children, pregnant women and sick persons should be forbidden to work with dangerous plants.

Based on the work in the field, the Institute for the Protection of Nature is given information for drawing up plans for the complete or partial local protection of the plants that are of the greatest importance for medicine, the pharmaceutical industry, exportation, phytosociology, and plants that have become rare in some regions owing to uncontrolled gathering, such as *Gentiana lutea, Erythraea centaurium, Drosera rotundifolia, Adonis vernalis, Arnica montana, Paeonia tenuifolia, Primula veris, Arctostaphylos uva ursi, Althaea officinalis, Valeriana officinalis* and others.

In the course of ten years' field work of this nature, linking theoretical and practical knowledge, the production and quality of Yugoslav drugs have perceptibly improved. Almost all the forest lands of eastern Yugoslavia have been studied, and a new applied science has been created of great importance from the health, social and economic standpoints.

Plants Grown at Experiment Stations

Althaea officinalis
Brassica nigra
Digitalis purpurea
Digitalis lanata
Carum carvi
Chrysanthemum cinerariaefolium
Coriandrum sativum
Glycyrrhiza glabra
Foeniculum vulgare
Foeniculum dulce
Hyssopus officinalis
Mentha piperita "Mitcham"
Origanum majorana
Salvia officinalis
Salvia sclarea
Sinapis alba
Thymus vulgaris
Valeriana officinalis
Lavandula vera

Figure 2. *View of the upper part of roots of white Saponaria* (Gypsophila paniculata *L. - Caryophyllaceae*) *planted on the Deliblato shifting sand dunes east of Belgrade in order to fix them. After three years, the root penetrates the soil vertically to a depth of 4 meters.*

Plants Grown on Sand Dunes

Chrysanthemum cinerariaefolium
Mentha piperita
Hyssopus officinalis
Origanum majorana
Melissa officinalis
Althaea officinalis
Foeniculum vulgare
Coriandrum sativum
Calamintha officinalis
Digitalis purpurea
Thymus vulgaris
Rheum palmatum
Atropa belladonna
Salvia officinalis
Salvia sclarea

Habitats

The habitats of the medicinal plants and of the drugs derived therefrom have been mapped out according to the climate, altitude and soil, and are as follows:

Adriatic region

Mediterranean climate. Karstic soil ($CaCO_3$), denuded. The most important aromatic and medicinal plants from the economic standpoint are:

1. *Salvia officinalis — Folium et herba Salviae* (approximately 1 million kilograms per year), *aetheroleum* (etherial oil) (10,000 - 30,000 kilograms).
2. *Rosmarinus officinalis — Rosmarini folium et aetheroleum* (5,000 – 9,000 kilograms of essence).

3. *Chrysanthemum cinerariaefolium — Pyrethri flos.*
4. *Punica granatum — Granati cortex, fructus, pericarpium, succus.*
5. *Artemisia absinthium — Absinthii herba, folium, aetheroleum.*
6. *Ceratonia siliqua — Ceratoniea fructus.*
7. *Helichrysum angustifolium — Helichrysi aetheroleum.*
8. *Urginea scilla — Scillae bulbus.*
9. *Olea europaea — Olivae fructus, oleum.*
10. *Lavandula vera, L. spica — Lavandulae flos, herba, aetheroleum.*
11. *Amygdalus communis — Amygdali semen, oleum.*
12. *Citrus limonum — Limoni fructus, folium pericarpium, aetheroleum.*
13. *Citrus aurantium, var. amara — Aurantii amari fructus, pericarpium, aetheroleum, flos et folium.*
14. *Laurus nobilis — Lauri folium, fructus, oleum.*
15. *Juniperus sabina — Sabinae herba.*
16. *Juniperus oxycedrus — Juniperi oxycedri fructus, lignum, aetheroleum.*
17. *Juniperus macrocarpa — Juniperi macrocarpae fructus, lignum, aetheroleum.*
18. *Juniperus communis — Juniperi fructus, lignum, pix, aetheroleum.*
19. *Ficus carica — Caricae fructus.*

Salvia officinalis is the most important for exportation. It is also a good fixer in the karst.

High mountain regions

Altitude 1,500 - 2,700 meters. Forests of *Fagus, Pinus, Abies, Picea, Juniperus* Pastures. Humid climate.

1. *Arctostaphylos uva-ursi — Uvae ursi folium.*
2. *Vaccinium myrtillus — Myrtilli fructus, folium.*
3. *Cetraria islandica — Lichen islandicus.*
4. *Colchicum autumnale — Colchici semen, tuber.*
5. *Orchis, Ophrys, Gymnadenia — Salep tuber.*
6. *Veratrum album, V. nigrum — Veratri rhizoma et radix.*
7. *Polygonum bistorta — Bistrotae rhizoma.*
8. *Potentilla tormentilla — Tormentillae rhizoma.*
9. *Primula veris, P. elatior — Primulae rhizoma, radix, flos et folium.*
10. *Rhamnus fallax — Fallacis cortex.*
11. *Helleborus odorus, H. multifidus — Hellebori nigri rhizoma.*
12. *Aspidium filix mas — Filicis maris rhizoma.*
13. *Atropa belladonna — Belladonnae radix et folium.*
14. *Aconitum variegatum — Aconiti tuber et folium.*
15. *Teucrium montanum — Teucrii montani herba.*
16. *Teucrium chamaedrys — Teucrii herba.*
17. *Satureia montana — Satureae montanae herba.*
18. *Thymus serpyllum — Serpylli herba et aetheroleum.*
19. *Gentiana lutea — Gentianae radix*
20. *Daphne mezereum — Mezerei cortex.*

Mountainous and hilly regions

Altitude, 500 - 1,500 meters. Forests consist mainly of *Quercus, Fagus, Carpinus, Fraxinus,* etc. More or less dry climate.

1. *Digitalis lenata — Digitalis lenatae folium et semen.*
2. *Scopolia carniolica — Scopoliae radix et folium.*
3. *Tilia cordata — Tiliae flos.*
4. *Erythraea centaurium — Centaurii herba.*
5. *Tussilago farfara — Farfarae folium et flos.*
6. *Sambucus nigra — Sambuci flos.*
7. *Rhamnus frangula — Frangulae cortex.*
8. *Rhamnus cathartica — Rhamni catharticae fructus.*
9. *Valeriana officinalis — Valerianae rhizoma cum radicibus.*
10. *Juniperus communis — Juniperi fructus, lignum, pix et aetheroleum.*
11. *Rosa canina — Cynosbati fructus.*
12. *Prunus spinosa — Pruni spinosae fructus et flos.*
13. *Crataegus oxyacantha — Crataegi flos, fructus et folium.*
14. *Fraxinus excelsior — Fraxini folium.*
15. *Betula alba — Betulae folium, gemmae et cortex.*

Then the plants previously mentioned with reference to high mountain regions under numbers 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 16, 18 and 20.

Regions subject to flooding

Lowlands, willow forests, continental climate.

1. *Althaea officinalis — Althaeae radix, flos et folium.*
2. *Valeriana officinalis — Valerianae rhizoma cum radicibus, aetheroleum.*
3. *Rhamnus frangula — Frangulae cortex.*
4. *Symphytum officinale — Symphyti radix.*
5. *Taraxacum officinale — Taraxaci radix, folium et herba.*
6. *Acorus calamus — Calami rhizoma et aetheroleum.*
7. *Equisetum arvense — Equiseti herba.*
8. *Mentha aquatica et altera — Menthae vulgaris folium herba, aetheroleum.*
9. *Mentha pulegium — Pulegii herba, folium et aetheroleum.*
10. *Inula helenium — Inulae radix.*
11. *Orchis palustris — Salep tuber.*
12. *Rubus caesius — Rubi folium.*
13. *Quercus robur — Quercus cortex.*
14. *Plantago major, P. lanceolata — Pantaginis folium.*

Principal Pests and Diseases of Eucalypts outside Australia

FAO Staff

The extensive Eucalyptus plantations created in many countries have so far suffered relatively little from attack by insects or diseases, and even such damage as has been caused has apparently been generally insignificant. But it is evident that the establishment of pure Eucalyptus plantations on a large scale creates a risk of possible serious attacks that could result in a dangerous setback to the economic use of these quick-yielding species. The following paper gives only a brief description of present conditions and is obviously incomplete. Readers are invited to submit supplementary information to the Forestry Division of FAO.

Nurseries and young plantations have suffered severe damage from termites. There is a considerable literature on general eradication methods so that it is sufficient to mention that aldrin, parathion and DDT (chlorinated carbohydrate) as well as spraying with sulphur and especially with HCH, have given excellent results. In East Africa, principally in the dry regions where termites endanger Eucalyptus plantations up to 3 to 4 years old, HCH powder and dieldrin are used for protection around individual plants (15 grams per plant); but it is evident that the larger the area of soil treated, the more effective is the treatment, as the moment the roots spread beyond the treated area, they are attacked. In making plantations, very vigorous and healthy plants must be used and planting should be at a sufficiently close spacing so that, after an attack, an adequate number of plants still survive. *Eucalyptus maculata* seems to be more resistant than other species, while *E. citriodora*, *E. saligna* and *E. maideni* are very sensitive.

In Malaya, the same method is used. *E. deglupta* is the more resistant. In Brazil, white arsenic, lead arsenate and sodium arsenate have been tried with success by mixing them with the soil around the planting holes at a proportion of 3 to 4 percent. Lead arsenate and white arsenic are the most effective, but the latter is the most economical. HCH (0.45 percent Isomer gamma) has given even better results than arsenic, a concentration of 6 grams to 100 grams of soil being the best. Equally good results are obtained by mixing HCH with the soil in the earthenware pots in which plants are raised: DDT, on the contrary, has proved almost totally ineffective. In Brazil, *E. alba*, *E. resinifera*, *E. paniculata* and *E. punctata* have proved the most resistant species to termites.

Ants

The genera *Atta* and *Acromyrmex* have proved to be very noxious in South America and represent the greatest danger to plantations and nurseries. Although these genera are present in nearly all areas, they seem to be less prevalent in low sandy or permanently cultivated lands. In Argentina, it is considered that the presence of 50 anthills per hectare will justify the cost of operations to destroy the pests before planting Eucalypts. In fact, effective control of these insects is difficult and costly. If only four or five nests remain, these are sufficient to result in grave damage.

The ants injure the leaves and the buds seriously enough to cause the death of a plant. This necessitates constant inspection during the second and third years following planting. Many insecticides have been used, either in gas or liquid form, to destroy the ant hills. To be effective they must penetrate into the fungus food crop and kill the queen. Sulphur dioxide, either pure or mixed with arsenic, carbon disulphide (approximately from 60 to 200 cubic centimeters per ant hill according to its size) are both insufflated or blown into the anthill by means of a special instrument. Methyl bromide is much used in Brazil and requires only a receptacle with a tube which penetrates into the ant hill (approximately 3 cubic centimeters per square meter of ant hill; 1 kilogram per 30 ant hills). A mixture of methyl bromide and 20 percent chloropicrine or methyl bromide and 80 percent of carbon disulphide is also used. HCH is used either as a powder which is injected by pressure into the middle of the ant hill or as a liquid; the best results are achieved by 200 grams per ant hill of the powder at 20 percent (2.4 percent Isomer gamma) or especially with a mixture of 100 grams at 50 percent (6 percent Isomer gamma) dispersed in 10 liters of water. Chlordane and lindane are used dispersed in water or sprayed on the ground or even onto the plants. Aldrin (1 to 2 kilograms per hectare), endrin and especially dieldrin are effective. The latter is insufflated under pressure at a density of 2 to 5 percent into the center of the ant hills or well placed all around the ant hills to prevent the ants from leaving them. In Brazil, placing the insecticide around each plant in a ring of bamboo has also been tried with success.

Gonipterus scutellatus

This weevil, Australian in origin, is certainly up to now one of the insects which has caused most damage to Eucalyptus plantations. *Gonipterus scutellatus* has been found in New Zealand, South Africa, Southern Rhodesia, Kenya, Uganda, Mauritius and Madagascar. It mostly attacks *Eucalyptus maideni*, *E. viminalis*,

E. globulus, *E. camaldulensis*, *E. robusta*, *E. citriodora* and *E. smithii*. On the other hand, *E. saligna*, *E. cladocalyx*, *E. melliodora*, *E. crebra*, *E. fastigata*, *E. paniculata* and *E. maculata* seem to be resistant. There is a considerable literature on this insect and the methods of its control, and it is sufficient to point out here that it is attacked by a hymenopterous parasite *Anaphoides nitens*, also of Australian origin, which has been spread generally with success, and its dispersion is rapid. For example, in the Island of Mauritius, *Gonipterus scutellatus* attacks are now only sporadic and isolated.

In South Africa, success has been practically complete except at high and dry altitudes (from 1,300 to 2,000 meters) where this parasite, though very resistant, does not thrive. Nevertheless, even here satisfactory results have been achieved except in certain cases with *E. viminalis*. The success of this control varies greatly from one area to another, particularly on high plateaus, and local climatic conditions and soil have a definite influence. A certain equilibrium has now been reached, but this can be upset, for example, by a year of drought or by an increase in competition among the trees. This biological control has proved very economical and efficient, and only in very rare cases it is necessary now to abandon plantations of *E. viminalis*.

In New Zealand, *Gonipterus scutellatus* attacks *Eucalyptus globulus* and *E. viminalis*, to a lesser degree *E. radiata* and *E. gunnii* and not at all *E. linearis* and *E. amygdalina*. The introduction of *Anaphoidea nitens* has also been a success in this country.

Ericoccus coriaceus

Also reported in New Zealand is a Coccid which has caused serious damage mainly to *Eucalyptus globulus*, *E. viminalis*, *E. gunnii* and *E. macarthuri*, while *E. amygdalina*, *E. obliqua*, *E. stuartiana*, *E. eugenioides* are attacked to a lesser degree. This insect is to be found on the branches and principal veins of the leaves and discharges a liquid on which there develops a fungus of a distinctive black color. However, due to a Coccinella, *Rhizobius ventralis*, imported from Australia and to a fly, *Pseudoleucopis benefica*, and a lepidopterous insect, *Stathmopoda melanchra*, this pest does not now present a great danger to Eucalyptus plantations.

Phoracantha semipunctata

This insect is a coleopterous Cerambycid originating in Australia and spread over South Africa on *Eucalyptus globulus*, *E. diversicolor* and *E. saligna*. *E. paniculata*, *E. fastigata* and *E. cladocalyx* are not affected. In Southern Rhodesia, it occurs on *E. saligna* and *E. botrioides*, although *E. camaldulensis* and *E. citriodora* are not affected. In Chile and in Argentina, it is found on *E. globulus* and *E. viminalis*, and in the East Mediterranean region on *E. globulus* and *E. camaldulensis*. Felled trees are subject to attacks, as are standing trees in poor condition, or young trees from 15 to 20 centimeters in diameter in not very favorable situations (Cyprus, Israel). The larva of the insect bores a tunnel in the wood, making it unusable and, by destroying the cambium, causing the death of the tree. The methods employed in Cyprus against this insect are the felling and burning of affected young trees. Trap trees are employed in South Africa. In Israel, important work has been done in the treatment of Eucalyptus poles immediately upon felling.

Other insects

Various other insects attack Eucalyptus in South America but none are of great importance from the point of view of destructive power. As regards Brazil, mention may be made of two Lepidoptera, a Geometrid, *Thyrinteina arnobia*, which can be destroyed with DDT 2 ½ percent; and a Lymantrid, *Phassus giganteus*, which hollows out galleries where lianes touch the tree. The following Coleopters, which are also reported from Brazil, are listed in order of importance: *Sternocolapsis quatordecimoostata* especially on *E. citriodora*, *E. alba* and *E. maculata* while *E. globulus* is not attacked, and *E. saligna* very little. It is treated with HCH powder (1 percent Isomer gamma) or liquid (250 grams of powder 12 percent Isomer gamma dispersed in 100 liters of water). *Costalimaita ferruginea* which comes from the cotton plant and attacks in particular *E. citriodora*; it can be treated with HCH in powder (1 to 1.5 percent Isomer gamma). *Colaspis quadrimaculata* and *Bolax flavolineatus*. These last two are of lesser importance.

In Argentina, *Gonipterus gibberus* is reported; against this is employed HCH at 10 percent or chlordane at 5 percent. Biological control measures against this pest are in the course of development. In Argentina also, the larva of a Coleopter, *Dyscinetus gagates*, eats into the bark of young plants causing their death. Dieldrin or chlordane are employed to fight it.

Argentina and Brazil report a Thrips, *Isoneurothrips australis* originating in Australia, which destroys the inflorescence of Eucalypts.

In Ecuador, larva of a Cerambycid, *Paramallocera ilinizae*, has been found to bore into the bark and the cambium, sometimes causing the death of the tree.

In New Zealand the most important insect is a Chrysomelid, *Paropsis dilatata*, which has caused great damage in South Island on plantations of *E. globulus*, *E. radiata*, *E. viminalis*, *E. regnans*, *E. gunnii*, *E. obliqua* and *E. eugenioides*. Against this no biological means of destruction have yet been found, in spite of various trials. A Chalcid, *Rhicnopeltella eucalypti*, which attacks solely branches of *E. globulus*, has resulted in the plantations in several regions having to be abandoned as no means of destruction have been found to date. Lastly, there is a Psyllid, *Rhinocola eucalypti*, infested successfully by a Eulophid, *Pteroptrix maskelii* and a Tortricid, *Eucolapsis brunnea*.

Fungi

Apart from damping-off fungi, many other diseases are reported but on the whole are of little importance. For instance, in South America there is Gommosis of

Eucalyptus citriodora which causes injury and decay of the collar; a tumor of the stem of the young plant due to a species of *Cylindrocladium*, and *Ganoderma sessile* which attacks the injured trees.

Botrytis cinerea is reported in various countries: in Portugal and Argentina on *E. camaldulensis*; in Brazil, on *E. citriodora*, *E. botrioides*, *E. alba*; Kenya on *E. globulus*, *E. camaldulensis*; in Italy, on *E. globulus*. This is not, however, of great economic importance. It attacks the seeds in the nurseries or the very young trees which are not in good condition. In South Africa, attacks of *Ganoderma colossum* are reported especially on *E. maculata* and *E. paniculata*; of *Lembosiopsis eucalyptina* on the foliage of *E. delegatensis* and *E. globulus*; of *Stereum hirsutum* on the stool shoots of *E. globulus*, bringing on an infection of the shoots and, subsequently, decay of the heart, also on *E. diversicolor* of over 40 years, and on the shoots of old stumps of *E. saligna*. The latter is avoided by limiting the rotation to less than 30 years and cutting the stumps to the ground.

In Italy, the Belgian Congo, and in South America, the fungus *Cercospora eucalypti* is reported on Eucalyptus leaves. In Morocco, *Hypoxylon mediterraneum* lives particularly on *Quercus suber* but attacks also *E. camaldulensis*, *E. gomphocephala* and *E. robusta*. In Cyprus a canker is reported which seems to be connected with the presence of *Phoracantha semipunctata*.

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Commodity Report

Plywood

In the last Unasylva *review of the world plywood market (Volume 10, Number 3, 1956) a general appraisal was made of postwar developments in production and trade up to 1955.*[1] *Since then the statistical coverage obtained by FAO has noticeably improved and data from more countries have been collected. In the following report a short review is given of the most significant developments of the period 1946 to 1957, but main emphasis is laid on the more recent developments between 1955 and 1957.*

World production of plywood increased during the period 1946-1957 from 3.11 million cubic meters to 11.94 million cubic meters, or by almost four times. The largest volume increase took place in the U.S.A. where output rose by over 4 million cubic meters from 1.8 million cubic meters in 1946 to 5.87 million cubic meters in 1957. The largest relative increase, however, occurred in Asia (chiefly Japan) where the production of plywood in 1957 amounted to more than 10 times the 1946 output. Tables 1 and 2 show the development of production by regions and by most important producing countries.

Table 1. – Regional Distribution of World Plywood Production

Region	1938		1946		1955		1956		1957*	
	1000 m³	%	1000 m³	%	1000 m³	%	1000 m³	%	1000 m³	%
Europe	1 090	36	520	17	2 155	20	2 130	18	2 250	19
U.S.S.R.	885	29	252	8	1 049	10	1 122	10	1 200	10
North America	820	27	1 990	64	6 245	57	6 575	57	6 650	56
Japan	207	7	67	2	683	6	852	7	950	8
Others	38	1	281	9	858	7	841	8	890	7
Total	3 040	100	3 110	100	10 990	100	11 520	100	11 940	100

* Estimated

The postwar demand for materials for building, repair, and reconstruction brought about a rapid increase in the capacity and production of plywood almost everywhere in the world, but the rate of annual growth has, in general, significantly slowed down in recent years. Table 3 shows the three-year moving average of annual growth of world and regional plywood production during the period 1946 to 1957. Several interesting features emerge from this Table.

For instance, the regularity of growth has been greatest in *North America*, whereas in *Europe* considerable fluctuations are apparent in the development. The greater sensitivity of European countries to changes in international market conditions may be the principal explanation, but in many countries the plywood industry seems to have reached the limits of both suitable raw material supplies and current demand. The recent rapid expansion of the particle board industry, combined with the already well-established and growing fibreboard industry in Europe, together represent an increasing competition for the European plywood manufacturers.

In the *U.S.S.R.*, plywood output had after the war fallen to very low levels indeed. The relatively rapid rate of growth of production up to 1952 can therefore be explained by the great efforts made to recover prewar levels. This having been achieved by 1952, the course of expansion became calmer and followed a more regular and modest trend of annual growth.

In *Latin America*, the development of production shows a more irregular trend than in most other regions. The decline during the first three-year period was a result of the difficulties encountered by Brazilian manufacturers on export markets and reflected a certain early excess capacity. Later, however, when the domestic demand had caught up with the current production capacity and was even continuing to rise rapidly, new capacity was added to the old. In particular, the period 1950-1951 seems to have been one of rapid expansion.

[1] The revised statistical data by regions and countries on production and trade of forest products are published in FAO's *World Forest Products Statistics*, 1946-1955.

But also, in this region, the rate of growth gradually slowed down towards 1956 and 1957.

In *Africa*, although this region is not particularly important in the sense of volume, the principal period of expansion was in the years from 1951 to 1953, when production in one single year, 1952, doubled to follow the pattern of growth which was apparent in most other regions.

Asia, on the other hand, is the region where plywood production has continued to rise rapidly throughout the review period. Steadily increasing domestic demand, together with new and expanded export outlets, have made this development possible. In the *Pacific* area, the development of plywood production shows an unusual irregularity and does not, in any way, follow the general trends noticeable elsewhere. As the area is a relatively small importer and exporter, the explanation appears to lie in fluctuations of demand within the region.

In general, world plywood production seems to have progressed in recent years much in line with general industrial and economic activity. The gradual decline of annual expansion towards 1956 and 1957 corresponds to that of general industrial activity; there is at present marked stagnation in the latter, so that it may very well be expected that, in North America and Europe, any growth of plywood output in 1958 will be relatively small.

With regard to postwar world trade in plywood, many interesting features emerge from the data now available (Tables 4 and 5). While the volume of world trade in 1946 to 1947 was some 11 percent of total world production, this relationship appears since 1951 to have become stabilized at around 9 percent. Certain significant changes have taken place in the relative importance of the principal exporting countries. In 1946, Finland and North America alone represented about 76 percent (respectively 41 and 35 percent) of total world exports of plywood. Since then, the share of North America has fallen rapidly to around 9 pecent in 1956 and 1957. Finland's share, although still significant, has also fallen heavily and was only 25 percent and 23 percent respectively in 1956 and 1957.

TABLE 2. – WORLD PRODUCTION OF PLYWOOD
(in 1,000 cubic meters)

Region	1946	1955	1956	1957*
Europe	*520*	*2 155*	*2 130*	*2 250*
of which:				
Finland	150	363	271	300
France	44	226	256	280
Germany, Western	60	649	658	700
Italy	25	150	140	..
Portugal	2.1	6.2	8.7	..
Spain	27	48	56	..
United Kingdom	36	54	49	50
Yugoslavia	7.4	39	39	45
U.S.S.R.	*252*	*1 049*	*1 122*	*1 200*
North America	*1 990*	*6 245*	*6 575*	*6 650*
of which:				
Canada	192	684	777	780
United States	1 800	5 560	5 800	5 870
Latin America	*145*	*350*	*360*	*370*
of which:				
Argentina	20	39	46	..
Brazil	110	246	246	250
Africa	*40*	*200*	*210*	*220*
Asia	*105*	*870*	*1 010*	*1 130*
of which:				
India	15	55	55	60
Israel	—	21	21	27
Japan	67	683	852	950
Philippines	..	40	55	66
Pacific Area	*60*	*125*	*115*	*120*
of which:				
Australia	49	91	88	90
New Zealand	10	20	17	20
WORLD TOTAL	*3 110*	*10 990*	*11 520*	*11 940*

* Estimated

The country which has increased its exports most rapidly, both as regards a share in the world market and actual volume, is Japan. From nothing in 1946, Japanese plywood exports in 1956 amounted to 30 percent, and in 1957 to 27 percent of total world ex-

TABLE 3. – ANNUAL RATE OF GROWTH OF WORLD PLYWOOD PRODUCTION, 1946-1957
(in percent - three-year moving average)

Region	1947/49	1948/50	1949/51	1950/52	1951/53	1952/54	1953/55	1954/56	1955/57
Europe	+ 29	+ 23	+ 23	+ 13	+ 8	+ 8	+ 12	+ 9	+ 3
U.S.S.R.	+ 32	+ 29	+ 21	+ 16	+ 13	+ 10	+ 6	+ 6	+ 5
North America	+ 11	+ 16	+ 15	+ 15	+ 11	+ 7	+ 15	+ 10	+ 10
Latin America	— 6	+ 28	+ 41	+ 34	+ 11	+ 5	+ 13	+ 7	+ 8
Africa	+ 4	+ 7	+ 10	+ 44	+ 47	+ 44	+ 13	+ 7	+ 5
Asia	+ 26	+ 14	+ 28	+ 27	+ 36	+ 29	+ 27	+ 24	+ 17
Pacific	+ 9	+ 14	+ 4	— 4	+ 2	+ 6	+ 25	+ 14	+ 9
WORLD	+ 16	+ 18	+ 18	+ 16	+ 12	+ 9	+ 13	+ 10	+ 9

Table 4. – Exports and Imports of Plywood
(most important countries' share of world total)

Region	1946	1951	1955	1956	1957
	..... Percent				
Exports					
Finland	41	44	32	25	23
North America	35	7	8	9	9
Japan	—	8	23	30	27
U.S.S.R.	3	12	9	5	8
Imports					
United Kingdom	65	48	43	31	35
United States	4	7	37	46	40
World Exports as Percent of World Production	11	9	9	8	9

ports, and thus made that country the world's number one plywood exporter.

The U.S.S.R. which, in 1946, represented only 3 percent of total world exports, had reached 12 percent by 1951. Since then the Soviet share in plywood exports has declined somewhat and seems now to be set at a level somewhere close to the North American share.

The United Kingdom was, in 1946, by far the largest plywood importer of the world with 65 percent of total imports, but since has gradually been declining in importance; imports in 1956 in fact represented only 31 percent and in 1957 35 percent of the world's totals. The United States, on the other hand, a small importer in 1946 with only 4 percent total imports, has gradually risen to number one country with 46 percent in 1956 and 40 percent in 1957. The growing importance of Japan as an exporter, and that of the United

Table 5. – World Trade in Plywood
(in 1,000 cubic meters)

Region	1946	1950	1951	1952	1953	1954	1955	1956	1957
	Exports								
Europe	*165*	*270*	*415*	*295*	*320*	*450*	*500*	*390*	*475**
of which:									
Finland	136	195	278	221	215	298	320	229	250
France	—	13	24	11	21	31	42	27	30*
Germany, West	—	3.4	23	6.1	12	34	31	38	50*
Sweden	17	24	22	12	15	17	14	12	10*
U.S.S.R.	*11*	*48*	*76*	*63*	*50*	*62*	*89*	*47*	*90*
North America	*115*	*35*	*45*	*55*	*40*	*55*	*80*	*80*	*95**
of which:									
Canada	64	32	42	43	34	49	72	65	80*
United States	49	3.1	3.7	11	8.3	5.9	8.4	13	15*
Latin America	*45*	*20*	*30*	*15*	*20*	*15*	*20*	*25*	*25**
of which:									
Brazil	38	11	11	1.8	0.2	0.8	3.4	2.8	..
Chile	—	2.8	5.1	0.9	0.6	1.0	1.2	..	—
Africa	—	*10*	*20*	*25*	*40*	*45*	*50*	*60*	*60**
of which:									
Nigeria	—	9.2	10	10	12	12	15	15	..
Asia	—	*15*	*50*	*25*	*65*	*175*	*250*	*300*	*340**
of which:									
Japan	—	16.4	49.4	21.5	58.3	164.8	234.0	270	300*
Pacific Area	—	—	—	—	—	—	*10*	*10*	*10**
Total	335	400	635	480	535	800	1000	910	1100*
	Imports								
Belgium-Luxembourg	19	30	32	24	31	21	19	23	20*
Denmark	b 19	15	16	11	19	17	14	16	18*
Germany, West	b 25	16	20	22	21	15	12	13	18*
Greece	2	2.5	6.3	5.0	9.0	8.3	12	10	13*
Netherlands	8.6	30	40	18	32	36	41	40	45*
United Kingdom	217	183	304	256	147	332	428	278	387*
United States	14	37	44	51	130	256	370	417	..
Egypt	b 4	19	23	7	17	22	18	10	15*

* Estimated. *a*) Included in veneers. *b*) Includes veneers.

States as an importer, are in fact interdependent, since the largest share of Japan's exports has so far been destined to the United States. Shipping distances from Japan to other important markets, particularly in Europe, do not compare favorably with transport facilities to North America.

Production in 1956 and 1957

In 1956, world plywood production had risen by about 530,000 cubic meters from the 1955 level. The rise, however, was not evenly spread between all the principal producing regions or countries. Output in Europe declined slightly, while in North America and Asia it showed a noticeable increase.

The fall in Europe was primarily due to lower production in Finland where, because of less favorable export conditions particularly to the United Kingdom, output fell from 363,000 cubic meters in 1955 to as low as 271,000 cubic meters in 1956. Most other European countries, on the other hand, continued a modest upward trend in their plywood production. In 1957, the international market prospects improved somewhat and Europe's plywood production showed a further increase, discernible this time in the output of every country, but nevertheless still remained below the 1951, 1954 and 1955 levels. The relatively small increase in Finnish plywood production in that year was due to the general economic difficulties which were equally an obstacle to all Finnish exports in 1957 and which ultimately led to the devaluation of the Finnish Mark in September last. Of other European countries, the steady progress in Western Germany was one of the principal features.

In the U.S.S.R., production of plywood reached a new record in 1957, with about 1.2 million cubic meters. Most of the increase above the previous year's level is believed to have been used for greater exports which in 1957 reached a postwar high level, remaining nevertheless still considerably below the prewar volume of exports.

Plywood production in 1956 in North America showed an increase of 330,000 cubic meters over the 1955 level, but output in 1957 showed a further rise of only 75,000 cubic meters. It is perhaps surprising that any rise at all was recorded, given the generally adverse market conditions, particularly for building materials in general and for wood products in particular in the United States towards the end of 1956. It was the production of softwood plywood (about 84 percent of total plywood production) which showed a rise, while hardwood plywood apparently declined somewhat. Plywood in the United States has apparently found more diversified and less traditional outlets during recent years than in most other countries. If this is true, then the possibility of a further rise in the country's production even during 1958 cannot be excluded, although the general economic indicators at the time of writing point in the opposite direction.

In Latin America, the increase in production has slowed down considerably since 1955 and little new capacity, if any, has been added in the years 1956 and 1957. The years 1950, 1953 and 1955 were those of a particularly great production increase, probably as a result of extensions of plants and the completion of several new factories. Manufacturers in this region apparently prefer to see domestic consumer demand grow sufficiently before embarking on the construction of new factories or extensions in capacity.

Production of plywood in Africa suddenly doubled in 1952 and since then has shown a more moderate increase, at an annual rate of 5 percent in the years 1955 to 1957. The increase has been concentrated chiefly in the Union of South Africa; other countries have remained more or less stationary. Output in the Union of South Africa almost trebled from 1951 to 1952 (38,000 cubic meters and 100,000 cubic meters respectively) and has since increased at an annual rate of about 15,000 to 20,000 cubic meters. Domestic demand must have risen substantially to justify such an expansion, as exports seem so far to have remained relatively small. A relatively important increase has occurred in French Equatorial Africa, where output was practically nothing in 1950 but was 25,000 cubic meters in 1953 and has since then modestly but steadily increased further.

In Asia, as already mentioned, Japan has shown a spectacular growth of plywood production, from 149,000 cubic meters in 1950 to 683,000 cubic meters in 1955 and 950,000 cubic meters in 1957. This means that, during this period, Japan has progressed from being the world's seventh plywood producing country to number three producer, second only to the United States and U.S.S.R. It is obvious that the export trade, notably to the United States, has been one of the principal stimulators to the Japanese plywood industry.

Another country in this region where plywood output seems to be steadily increasing is the Philippines. From about 5,000 cubic meters in 1950 it reached 40,000 by 1955 and 66,000 by 1957.

In India, which until the postwar years depended primarily on imported supplies for its plywood requirements, a rapid progress in the domestic plywood industry has been noticeable. A tariff protection by a duty of 35 percent *ad valorem* until December 1960 has in fact made it possible for the Indian plywood industry to increase output from 15,000 meters in 1946 to over 60,000 cubic meters in 1957. The present capacity is stated to be adequate to meet the whole domestic demand for tea chests, the main utilization of plywood in India, although raw material difficulties have apparently been experienced by some factories. In Israel, output has changed little since 1955 after having rapidly risen from 7,600 cubic meters in 1952 to over 20,000 cubic meters. Exports, notably to the United Kingdom, have recently shown an upward trend.

In the Pacific Area, the production of plywood has not changed markedly over the past three years. Most

of the plywood produced is consumed on the home market. Exports from New Guinea go chiefly to Australia and New Zealand.

Trade

The year 1956 was marked by a certain decline in the volume of trade (Table 5), the second decline since 1952 in an otherwise steady postwar expansion. As in 1952, the decline in total world trade figures reflected a reduction in plywood imports by the United Kingdom. Minor increases in the imports of most other countries in 1956 were not sufficient to compensate for the considerable fall that took place in Britain, which, in 1955, had imported as much as 428,000 cubic meters (about 43 percent of total world imports). Demand in the year however did not rise as was apparently expected and the trade saw stocks rise excessively towards the end of the year. At the beginning of 1956, the main concern was to cut stocks to levels better corresponding to the generally reduced tempo of trading and to enter new import contracts only cautiously. The credit squeeze and hire-purchase restrictions also overshadowed the opening of the 1956 import campaign. All these factors generated apprehension about future price levels. In addition, the heavy stock holding, apart from a financial burden, was causing a shortage of storage space, and operators were being put to extra expense through having to send goods to unusually distant storage points. On the other hand, the total commitment of the United Kingdom plywood trade at the beginning of 1956, in the form of forward contract balances, amounted to something in the region of seven months' consumption. This was not a very healthy position in view of the prevailing fear of a price fall. Although a reasonable amount of consumer buying continued to take place, it was largely on a hand-to-mouth basis. Many importers also, under increased pressure from the banks, proceeded to reduce stocks at relatively low prices. In such a situation, the subdued level of new purchasing during most of 1956 was to be expected. The clearance of the British Government's stockpile of plywood at the end of July also kept the rate of new purchasing rather low. Towards the end of the year, a slowly improving trend became apparent, and by the time the 1957 campaign was to be opened, the trade looked forward with more confidence than a year earlier.

The reduced purchases by the United Kingdom in 1956 affected chiefly Finnish and Soviet export shipments, which both showed a marked fall from the 1955 level. Japanese exports, on the other hand, rose further in 1956, chiefly because of extensive purchases by the United States. Even in Britain, Japanese lauan-plywood was reported to have been steadily sought for, despite a certain strengthening of prices as a result of the favorable market in the United States. The result was a severe competition between the plywood mills in Japan. In order to prevent the sometimes chaotic position and supervise prices on the export markets, the Japanese Veneer Board decided to establish an Adjustment Association, which also has to check the installation of additional manufacturing capacity. These measures proved successful and the Japanese export trade seems to have settled down in the course of 1956.

In 1957, the world plywood market again showed a rather favorable development. The volume of trade rose, reaching a new record level and consumer demand seems to have been sustained. The level of stocks with the trade in the principal importing countries showed little change in the course of the year. At the beginning of the 1958 campaign, consumption prospects appeared rather satisfactory. The gradual decline of prices since 1955, particularly in Europe, had however made buyers in the principal importing countries cautious, and forward buying for 1958 progressed slowly. Even the Finnish and Soviet statements of not lowering their prices for 1958 did not seem to have given the necessary assurance for more active purchasing. In other parts of the world, no disturbing signs were in view at the opening of the 1958 season. Japanese exports seemed to find the same favorable response as in the earlier years.

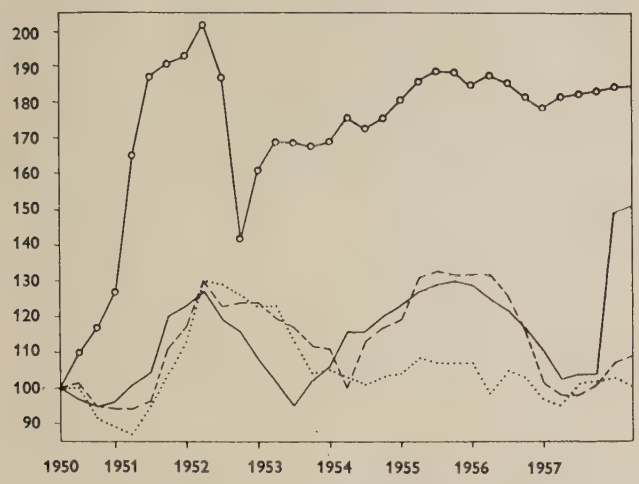
As mentioned earlier, the United Kingdom and the United States account for the great majority of world imports, although in the latter country imports represent only a fraction of the total consumption requirements. Japan, Finland, the U.S.S.R. and Canada, on the other hand, account for about threequarters of total world exports. Therefore, developments in any one of these countries, the importing countries in particular, may have a stronger influence on world market developments than all the less significant exporting and importing countries together. This is also the reason why market developments in the latter have not been referred to in this report.

Prices

In a previous review, a comparison was made between the development in 1950-1955 of plywood prices, on the one hand, and sawnwood prices on the other. This comparison brought up to date (see the Graph) shows that while sawnwood export prices by and large maintained their 1955 position in 1956 and 1957, plywood prices tended to weaken further. By contrast, the cost of labor and transport has steadily increased and this in turn has made it difficult for the plywood industry to follow the price trends for sawlogs. The unavoidable consequence of a weakness in plywood export prices had therefore been a shrinking offer of peeler logs to the industry. The Finnish plywood industry, in particular, has been facing serious difficulties. It is obvious also, that the great variety of different board products which during recent years has entered both the domestic and export markets, has tended to depress plywood prices or at least to prevent them from rising. The sudden rise in Finnish plywood export prices in October 1957, apparent in the Graph, was only a result of the devaluation of the Finnish Mark in September

and did not affect export prices quoted in foreign currencies. The increased export earnings came as a welcome aid to the Finnish plywood industry which, during 1956 and 1957, had experienced a weak demand abroad and rising costs at home leading to losses and to a temporary closing down of many factories.

Another interesting price comparison is presented in Table 6. It shows the average monthly and annual import (c. i. f.) values of Finnish, Soviet and Japanese



Comparison of plywood and sawnwood prices between Finland, Sweden and the United Kingdom. Index: January 1950 = 100. **Finland:** *average f.o.b. value for plywood and birch;* **Sweden:** *value of Scots pine $2^1/_2 \times 7$ in. (65 × 180 mm.) battens;* **United Kingdom:** *average c.i.f. value for imports of plywood.*

Finland	Sweden	United Kingdom (*Other wood*)	United Kingdom (*Birch*)

plywood imported into the United Kingdom. These values, representing the landed cost of plywood from the principal exporting countries, show fairly accurately the differences between the prices of plywood from different sources and also the development of these prices, particularly as the composition and qualities of imports should not have varied too much from year to year.

In general, Soviet plywood has during the past four years cost less to the British importers than Finnish plywood, while in 1952 it was slightly more expensive. This development, and particularly the rapid fall of Soviet prices since the end of 1956, appears to be rather unusual, as both the Soviet and Finnish plywood are made almost entirely of birch. Although Soviet plywood may, in general, be of somewhat lower quality and the sizes are perhaps less suitable to the British market, it seems unlikely that the composition and quality of Soviet shipments should have changed to such an extent in 1957 that the widened gap between the landed cost of the Soviet and Finnish goods could have been fully justified. The Japanese plywood prices or rather the c.i.f. value in the United Kingdom, on the other hand, have remained more stable. The fall in 1956, despite record freight rates in that year, was probably primarily due to the severe competition among Japanese plywood exporters referred to earlier.

As to the price developments of birch and other plywood, it seems that birch plywood is gradually losing ground to other species and that, therefore, the less favorable course of c.i.f. values could be largely a result of more severe competition from the ever increasing variety of other plywoods which enter the market every year.

The apprehension of British plywood importers with regard to a possible further decline in Finnish and Soviet plywood prices, despite assurances given by the shippers, is rather clear. Finnish plywood imported in 1956 cost on average 11 percent less per cubic meter than in 1955, and, in 1957, a further decline of 8 percent was noticed. In the case of Soviet plywood, the fall in 1956 was as much as 26.5 percent while, in 1957, the average cost further declined by 4 percent. It is clear that these successive price falls caused many difficulties to the importers whose stocks consequently tended to deteriorate in value, particularly as the consumers very rapidly took note of any new price concessions made by the Finnish or Soviet shippers. New losses resulting from further deterioration of stock values might therefore be difficult to support, particularly as in 1957 the profits of the importers did little to compensate the losses sustained during the two previous years.

Summary

The rapid expansion of the world plywood industry which was brought about by the general postwar growth of world demand for various raw materials and con-

Table 6. – Plywood Import Prices
(United Kingdom average monthly and yearly c.i.f. values - £st. per cubic meter)

Period	Finnish	Soviet	Japanese	Birch	Other
1952 Year	51.5	52.5	69.1	52.1	66.5
1953 Year	48.1	43.1	45.9	46.9	55.7
1954 Year	52.4	44.3	53.6	51.0	56.6
1955 January	56.2	52.9	53.7	55.3	58.7
April	56.3	54.7	54.9	56.2	58.3
July	56.1	53.8	55.5	54.8	57.6
October	56.2	54.9	53.0	55.8	58.0
Year	56.0	53.6	53.5	55.4	57.8
1956 January	55.4	54.8	48.8	55.4	53.6
April	53.1	54.9	46.8	53.2	57.2
July	48.8	43.6	47.1	48.9	56.4
October	46.2	36.7	48.9	43.0	53.7
Year	49.9	39.4	46.7	47.9	54.8
1957 January	43.5	36.4	50.6	41.6	51.8
April	43.5	38.1	57.4	41.6	55.2
July	45.7	36.8	53.8	42.6	55.4
October	47.6	39.3	57.0	45.2	56.3
November	49.9	39.2	55.5	46.1	54.0
December	48.7	38.0	53.8	46.9	55.9
Year	45.8	37.9	55.2	43.7	55.2

sumer goods, is gradually slowing down and, in fact, in many countries has already reached a stage of more or less stagnation. Only in those countries where the plywood industry traditionally relies on domestic consumption requirements is the upward trend still noticeable, although even in these countries the rate of growth is clearly falling. Competition between manufacturers, on both the domestic and export markets, is increasing considerably, not only because new species, categories and qualities of plywood have been introduced, but also because of the remarkable expansion of the fibreboard and particle board industries. Plywood manufacturers today have seriously to consider the new situation created by the great versatility of these competing materials for which considerable further progress is still in view. On the other hand, the expansion of the particle board industry, for instance, creates new possibilities for the combined use of both plywood and particle board, and may thus, particularly in the integrated plywood/particle board industries, serve both commodities by increasing the diversity of the produce.

The supremacy of plywood — once solidly established — as a versatile raw material is now being increasingly challenged by newer products. In its response to this challenge the plywood industry will no doubt multiply its efforts to improve production and glueing methods and to diversify utilization possibilities. The many efficient molding processes now in use in almost every plywood producing country and the various new surface applications, chemical treatments, etc., are only examples of the possibilities which still lie in store.

E. K.

FORTHCOMING MEETINGS

	1958	
4-15 November	Latin-American Forestry Commission (6th Session)	Guatemala
25 September - 10 October	International Chestnut Commission (4th Session)	Yugoslavia and Greece
18 October - 1 November	Near East Forestry Commission (2nd Session)	Iraq
	1959	
February	Asia-Pacific Forestry Commission (5th Session)	India
May	International Poplar Commission (10th Session)	Italy
June	European Forestry Commission (10th Session)	Rome
October	Regional meeting of pulp and paper experts	Far East
November	FAO Conference (10th Session)	Rome

The Work of FAO

Some Current Activities

World list of forestry periodicals

In 1953, FAO issued a first reference list of forestry periodicals and series published throughout the world. Since it was based on the complete list of literature currently reviewed by the Commonwealth Forestry Bureau, Oxford, in the preparation of *Forestry Abstracts*, it was entitled *Forestry Abstracts Coverage List.*

FAO handles its documentation interests through a Committee on Bibliography formed jointly with the International Union of Forest Research Organizations and presided over by Professor Eino Saari of Finland. This committee has recommended the compilation of a new up-to-date list to keep pace with the greatly expanding flow of forestry literature, and this work is now in hand, with the co-operation of the international documentation centers at Oxford, Reinbek and Washington.

When established, the new list will be published in an appropriate form. It will cover both regular periodicals and what are termed serials, that is publications issued as part of a systematic program but appearing at irregular intervals. Annual reports of forest administrations and much of the published work on research fall into this category.

Forest fire prevention in Venezuela

A technical assistance officer, Mr. R. L. Williams, recently completed an assignment of 18 months to advise on the forest fire problem in Venezuela. His help was asked for to determine the causes and occurrence of forest fires and the damage they inflict, as a basis for organizing a program of prevention and control.

He found that most fires are man-caused and their occurrence is most serious around areas of heavy population. They result every year in much damage to watersheds, forests, and ranges, and there is a great need for an aggressive campaign on the "ground level" to prevent fires.

The objectives of the FAO mission appear to have been met to a considerable degree in that the fire prevention campaign in Venezuela has been strengthened, a better fire detection system has been set up and is functioning, and an improved fire control organization has been established. The men trained by the FAO officer are reported to be enthusiastic in carrying forward the work. Measures which he advocated have been put partially into effect, for instance for prevention of fire through education; for presuppression action through training of lookout and fire-brigade personnel and through construction and maintenance of fire-breaks; for detection through construction on selected points of lookout towers with radio communications and through issuance of better forest maps; and for suppression through the continuous training of fire-fighting crews. A fire manual is being prepared.

Appraisal of resource potentialities

Assessing the world's agricultural, forestry and fisheries resources in relation to rapidly growing populations is a matter of mounting concern. Estimates made for the United Nations World Population Conference put the current rate of population increase at about 1.5 percent per annum or around one hundred thousand per day.

FAO is well equipped for giving a reasonably authoritative answer to the question as to how actual or potential resources in croplands, pastures and rangelands, and forests can be developed to meet this increase. On the one hand, FAO has special possibilities for bringing together and appraising the international fund of knowledge which is continually accumulating regarding resource potentialities: on the other hand, it is in a position to assist substantially in developing the methodology and terminology involved in resource surveys, and in the sifting and analysis of data useful for long-term planning.

To test the possibilities, two pilot surveys have been undertaken to evaluate the potentialities and optimum use-patterns of agricultural, forest and fisheries resources. One covers the Ganges-Brahmaputra region in the Far East, and the other the Euphrates-Tigris basin. Work on the first pilot area, after team visits from FAO Headquarters, is now sufficiently advanced to permit submission of a report to the governments concerned. A report on the second area will be completed later.

Arabic glossary of forestry terms

The Near East Forestry Conference, held at Amman at the end of 1952, requested FAO to prepare, as a matter of urgency, a glossary of technical forestry terms in Arabic. It would fill a long-felt want.

Some Arabic-speaking foresters of the region set to work immediately, and it was thanks to their devoted efforts that an Arabic-French-English glossary of about 1,000 words with definitions in Arabic could be issued by FAO in mimeographed form in 1954.

This original glossary was well received but there had not been time to submit it for approval to all parts of the Arabic-speaking world, so that naturally there was room for considerable improvement, both in new terms adopted and in showing regional variations.

A revision has just been started by two prominent foresters of the region, Mr. S. K. Shawki, the Director of Forestry in the Sudan, and Mr. H. Kittani, Director General of Forests, Iraq. It is hoped to add to the glossary a certain number of terms in common use in the field of wood technology and utilization. The final work will be submitted to recognized philologians for approval.

Latin-American forest research institute

A Latin-American forest research institute has now been functioning for two years at Mérida, Venezuela, in conjunction with the University of Los Andes. It has received generous financial support from the Venezuelan Government, from a number of other governments of the region, several private organizations in Venezuela, and several philanthropic foundations outside the region. FAO helps to finance the international staff.

The staff consists of Dr. A. J. Uzcategui-Burguera as Director, Dr. E. J. Schreuder as Technical Adviser, Dr. K. Hueck as forest botanist, Dr. R. Jorgensen as wood technologist and Dr. V. Sume as Chief of Documentation Service on a full-time basis, and several members of the faculty of the University of Los Andes on a part-time basis. These faculty members cover such fields as silviculture, forest management, botany, wood identification, forest inventory and economics, and pulp and paper. The equipment for laboratory and field work, and for documentation services continues to grow.

A series of publications was started with the issuing of Bulletin No. 1 which sets out the history, organization, personnel, and program of the Institute. Subsequent issues include one on *Swietenia macrophylla*, one on the genus *Cedrela*, and one on the forest regions of South America. These are obtainable directly from the institute.

The future of the institute will, it is hoped, be assured through the increasing support of Latin-American governments, and through the participation of research Fellows and students from many countries in the investigation and training programs which the Mérida staff is seeking to develop.

Research Fellowships

Of the ten André Mayer Fellowships awarded this year by FAO, two went to forest research workers, one from Finland, Mr. P. J. Viro, and the other from Thailand, Mr. Sorayut Karatna.

These Fellowships, named after the late Professor André Mayer, as a tribute to an outstanding figure in the scientific world and one of the founders of FAO, who was also a Professor of the *Collège de France*, and a member of the French Academy of Medicine and of the Academy of Science, are intended for career research workers who have already performed scientific work of high value in one of the technical fields of FAO's competence.

Mr. P. J. Viro is at present professor at the Forest Research Institute of the University of Helsinki. He has published scientific papers on soils and especially on the fertility of forest soils. The FAO Fellowship will defray his expenses for the time necessary for him to complete his work on forest soils, which will be carried out in his own laboratory as well as abroad in Switzerland, Germany and the United States. His studies will bear on methods of measuring and analyzing the fertility of forest soils and the standardization of such methods.

Mr. Sorayut Karatna is at present Chief of the North Thailand Forest Experiment Station at Chiengmai. He has been undertaking investigations on the growth and silvicultural characteristics of plantations of native and exotic tree species as compared with natural forests, research which has a practical bearing on forest management for many parts of Asia and elsewhere. Mr. Karatna is expected to continue his studies in the United States.

Of the five André Mayer Fellowships awarded for the first time in 1957, one was granted to Mr. Sumihiko Asakawa from Japan for comparative studies on the germinative capacity of the seeds of various forest trees.

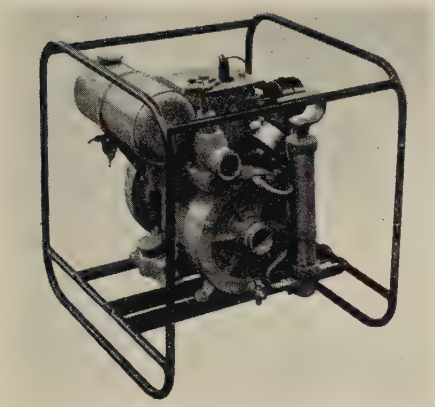
Since 1951 FAO has awarded over 1,450 Fellowships for study and advanced training under its Technical Assistance Program, 212 of them being in various fields of forestry. These Fellowships are, however, intended for the specialized training of technicians, particularly from the less developed countries where trained staffs are inadequate, whereas the André Mayer Fellowships are designed for award to experts who are already highly specialized. A rigorous system of selection has been introduced for candidates for the André Mayer Fellowships so as to maintain the highest standards of scientific research, and to make the award of one of these Fellowships a signal distinction.

Staff changes

Mr. Herman Tromp, who joined the staff of FAO in 1951, has resigned as Chief of the Forest Economics Branch, Forestry Division, in order to accept the Professorship of Forest Policy and Economics at the Federal Polytechnic Institute, Zurich. He has been replaced by Mr. J. C. Westoby who has been serving with the FAO Forestry Working Group at Geneva since 1952.

Miss Brigit Lindblom who has looked after the administrative arrangements of all field officers of the Forestry Division almost since the technical assistance program began, has been promoted to be Supervisor of the Recruitment Unit in FAO's Personnel Branch.

Equipment Section



IRRIGATION PUMP TYPE H.P. 1. — Industrial, four stroke, air cooled, high speed petrol engine incorporating impulse magneto ignition, hand speed control and splash type lubrication. Specially machined crankshaft and adaptor permit close coupling to pump. Manufactured in aluminium alloy. Complete unit mounted on tubular steel frame.

Specifications: Engine 288 c.c. develops 5.3. b.h.p. at 3500 r.p.m. (12 hour rating). *Maximum speed* 4000 r.p.m. *Performance* at pressure of 100 lb./sq.in. (7 kg/cm²) 1.500 imp. gal. per hour (6,819 lt). *Overall dimensions* 23 × 22 × 23 ½ in. (58 × 56 × 60 cm.). *Weight* 138 lb. (62.6 kg.).

Auto Diesels Limited, Uxbridge, Middlesex, England.

FWD "BLUE-OX" LOG SKIDDER MODEL BX. — Designed for skidding pulpwood in woods operations. *Specifications:* 4 wheel drive. Gasoline engine, 6 cylinders, 131 hp. Diesel engine also available. Transmission 5 speeds fwd., 1 rev. 2-speed auxiliary transmission. High range: 1st 6.5 m.p.h. (10.5 km/h); 5th 48 m.p.h. (77 km/h); and 6.7 m.p.h. (10.8 km/h) rev. Low range: 1st 3.3 m.p.h. (5.2 km/h); 5th 24. m.p.h. (38 km/h) and 3.4 m.p.h. (5.4. km/h) rev. Overall width 87 in (2.21 m.); overall length 179 in. (4.55 m.); ground clearance 14 in. (36 cm.).

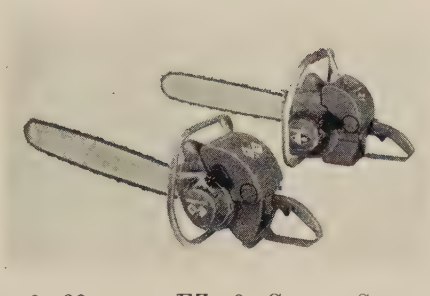
Tires 14.00 × 20 front and rear. Chassis weight with loaded rear tires, winch, cable, wing plates and counterweight front bumper 10,200 lb. (4,630 kg.).

The Four Wheel Drive Auto Company, Clintonville, Wisconsin, U.S.A.

"OLD-DELFT" SCANNING STEREOSCOPE. - Field of view can be moved in X - and Y - direction to scan 9 × 9 in. (23 × 23 cm.) photographs without shifting stereoscope or objects. System of rotating mirrors and prisms built into body of instrument. Two magnifications in ratio of 1 : 3 viz. 1½ and 4½ covering wide range of power. Stereoscopic vision automatically maintained when altering magnification. Pin-point reconnaissance obtained by switching to stronger magnification without interrupting observations. Slight differential of right-hand field of view eliminates any remaining Y-parallax in case of tilt difference between two pictures. Similarly, differential movement in X - direction for scanning obliques.

Two interpreters, each equipped with stereoscope, may view same image simultaneously.

N.V. Optische Industrie "De Oude Delft", Delft, Netherlands.



6 - 22 AND EZ - 6 CHAIN SAWS "POWER TWINS". — Two new chain saws both have a 6 hp engine. EZ-6 is direct drive, 19 lb. (8.6 kg.) unit; the 6-22 is a gear drive, 22 lb. (10 kg.) unit. EZ cuts through 8 in. (20 cm.) oak in 4 sec., 18 in. (46 cm.) pine in 12 sec.; fells trees up to 5 ft. (152 cm.) in diameter. Straight blade sizes from 14 to 60 in. (36 to 152 cm.). Gear-drive 6-22 fells trees up to 7 ft. (213 cm.) in diameter. Cuts through 20 in. (51 cm.) trees in 18 sec. Straight blade sizes from 12 to 30 in. (30 to 76 cm.). 6-22 has attachments available for quick switching from straight blade chain saw to brush cutter, to plunge-cut bowsaw and to clearing tool.

EZ-6 and 6-22 have diaphragm carburetors for cutting in any position, without adjustments or loss of power.

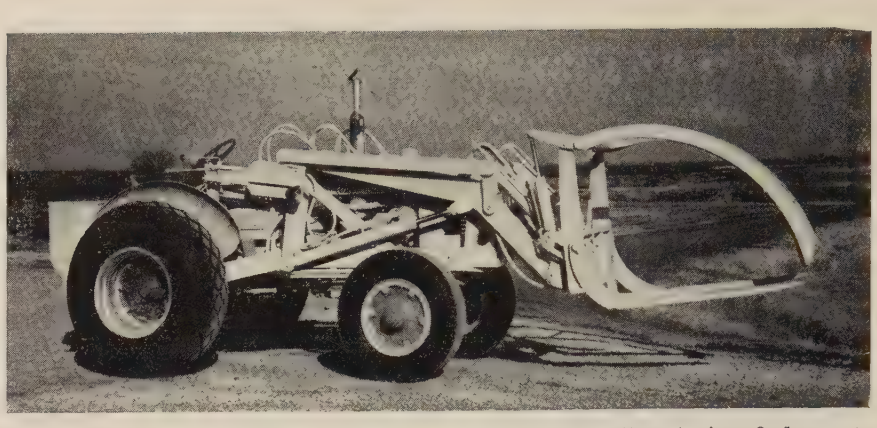
Homelite, Port Chester, New York, U.S.A.

Models 500 and 600 Chain Saws. — 500 model has 5 hp engine; 2 : 1 gear drive with automatic clutch. Weight 28 lb. (12.7 kg.). Carburetor for all-position operation. Bar size 15 in. (38 cm.) bow, 19, 24, 30 and 36 in. (48, 61, 76 and 91 cm.).

600 model has 6 hp engine; weight 28.5 lb. (12.9 kg.) for one or two man operation.

Three other models are available with 3 hp engine. Bar sizes: 14, 16 and 19 in. (36, 41 and 48 cm.). Weight 20.5 lb. (9.3 kg.) to 22.5 lb. (10.2 kg.).

Lancaster Pump and Manufacturing Company, Inc., Lancaster, Pennsylvania, U.S.A.



Ottawa Pulp Wood Clamp Fork. — Designed for loading, transporting and stacking logs, lumber or any material requiring device to hold down load. Clamp secures load when travelling over rough terrain and speeds all log handling operations. Clamp actuated hydraulically through special valve control section added to standard loader control valve. Double acting hydraulic cylinder actuates clamp through wide arc. Clamp closes down to forks and opens to 8 ft. 6 in. (2.59 m.) tip of clamp to forks, providing ample clearance for logs and lumber handling. Tilt back angle 18° and dump angle 40°.

Fork available in 30, 36, 42, 48 and 54 in. (76, 91, 106, 122 and 137 cm.) lengths, carriage in 48 in. and 64 in. (122 and 163 cm.) widths.

Capacities: model TL50 4,000 lb. (1,815 kg.), TL60 6,000 lb. (2,720 kg.), TL70 7,000 lb. (3,175 kg.).

L.A. Young Spring and Wire Corporation, Ottawa, Kansas, U.S.A.

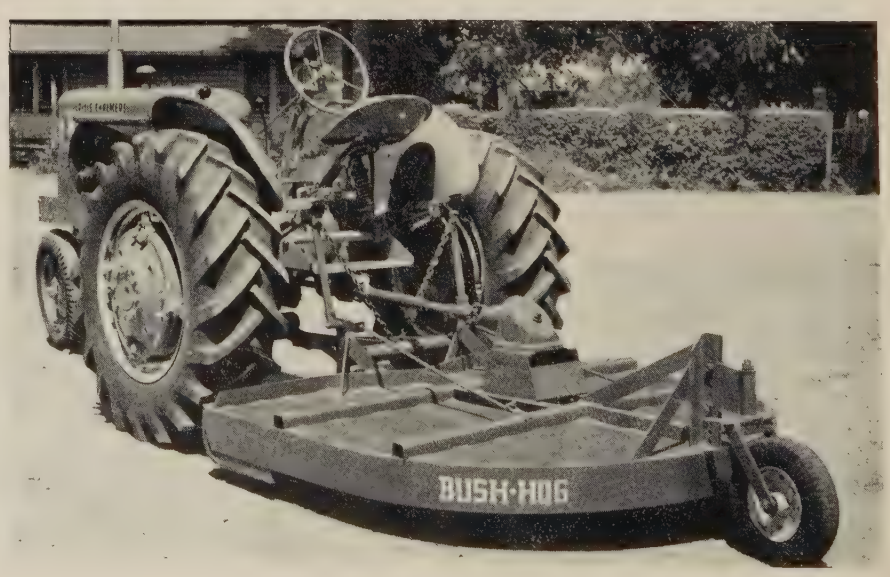
Timber Cruiser. — Designed to transport logs from cutting area to cold deck or mill. Finger-tip controlled from cab; power steering, air brakes. Operator has 2 or 4 wheel drive and 2 or 4 wheel steering.

Specifications: Length 24 ft. (7.32 m.) with blade straight; *Width* 8 ft. 6 in. (2.6 m.) blade angled or without blade, 10 ft. 4 in. (3.14 m.) with blade straight; *Height* 10 ft. 6 in. (3.20 m.); *Wheel base* 10 ft. (3 m.); *Turning radius* 10 ft. 4 in. (3.14 m.) in 4-wheel steer, 20 ft. 2 in. (6.15 m.) 2-wheel steer; *Weight* 27,110 lb. (12,297 kg); *Ground clearance* 16 in. (41 cm.) min.; *Engine* 150 hp.

Garrett Distributors, 800 Stevenson Ave., Enumclaw, Washington, U.S.A.

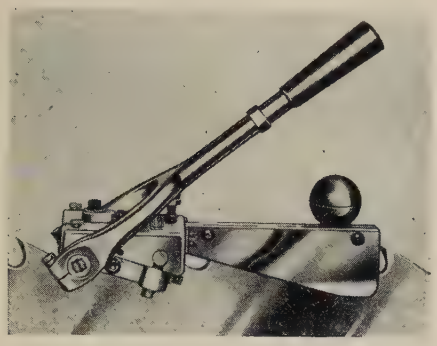
Bush-Hog. — One piece construction frame, free swinging blade held in cutting position by centrifugal force, but designed to fold back when construction is hit. Widths of cut 5, 6 and 7 ft. (1.52, 1.83 and 2.13 m.). Two models: lift and pull. For both height of cut is adjustable 2 in. to 12 in. (5 to 30 cm.). Cutting capacity for hardwood saplings is up to 2 in. in diameter. Pulled by any tractor; for the lift types with two or three point hitch. Also available for Willy's Jeep with three point hitch.

Bush-Hog Manufacturing Company, Inc., P.O. Box 491, Selma, Alabama, U.S.A.



4-Wheel Drive Rubber Tire D6 Tractor. — *Specifications:* Engine 110 hp at 1800 rpm; wheelbase 72 9/16 in. (1.84 m.); wheel gauge 93 in. (2.36 m.); overall tractor width 10 ft. (3.05 m.); overall tractor height (to top of air cleaner) 7 ft. 4 in. (2.24 m.); ground clearance, front axle 26 in. (66 cm.); chain case $10^3/_4$ in. (27 cm.); drawbar 26 in. (66 cm.). Approx. weight of unit: basic tractor 19,000 lb. (8,618 kg.); Fwd. 5 speeds with 18.00 × 25 or 18.00 × 24 tires; 1st 2.7 mph (4.1 km/h); 5th 14 mph (23 km/h). Rev. 4 speeds : 1st 3.4 mph (5.5 km/h); 4th 10.4 mph 16.7 km/h). Rimpull 13,150 lb. (5,965 kg.) in 1st speed.

Caterpillar Tractor Company, Peoria, Illinois, U.S.A.



Hand Shaper for Band, Gang and Circular Saws. — Device has single bevel side die with four working surfaces. Tooth stop provides accurate position of shaper on each tooth. Tooth stop as well as hand guards, handles and bench mounting interchangeable with either side shaper which can be adapted for different types of saws.

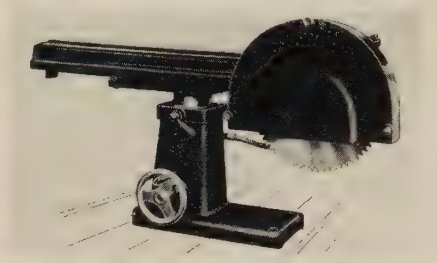
Armstrong Manufacturing Company, 2135 N.W. 21st Avenue, Portland 8, Oregon, U.S.A.

Type BSJ Crosscutting and Trenching Machine. — Main feature: swivelling is incorporated, swivels to 180° and can thus work two tables.

Specifications: Diameter of blade 16 in. (41 cm.); max. length of stroke 14½ in. (37 cm.), rise and fall 4 in. (10 cm.). Overall length of machine 50 in. (127 cm.); width 22 in. (56 cm.), height 21 in. (53 cm.).

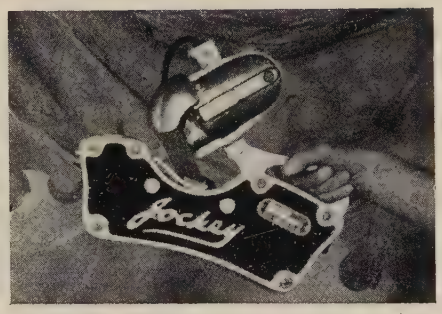
Saw blade can be utilized at any angle. Machine is bench type, supplied with or without stand.

A. Whitehead and Company (Halifax) Ltd., Well Lane Works, Halifax, Yorkshire, England.



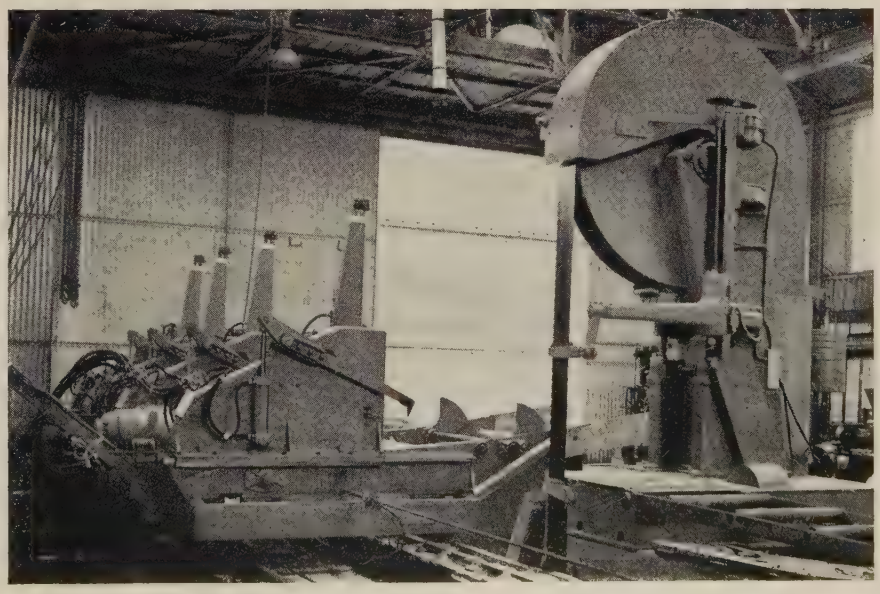
Model E-54 "Jockey" Electric Grinder. — Designed for sharpening inserted tooth saws on the machine. No clamping of saw, mounts over saw tooth. No lifting, pushes from one tooth to next. Sharpens any diameter, pitch or hook line of all hard tooth, high speed steel or standard inserted tooth types. Tooth stop guarantees correct location of grinding wheel to saw tooth. *Specifications:* Weight 12 lb. (5.4 kg.). Motor ¼ hp 3600 rpm, air cooled, 2 types 110 Volt or 220 Volt, operates on AC and DC current. Grinding wheel 4½ in. (11.4 cm.) diameter. Swivel bolt adjusts for any angle or hook.

Hanchett Manufacturing Company, Big Rapids, Michigan. U.S.A.



Stenner Bandmill Vq.60 in./Cq.41 in. — Weight 13 t. occupies area 70 by 21 ft. (21.3 × 6.4 m.). 190 hp. Designed for sawing softwood or hardwood logs up to 48 in. (122 cm.) dia. and 22 ft. (6.7 m.). long. Operated by one man.

Stenners of Tiverton Limited, Tiverton, Devon, England.



News of the World

Albania

• A newspaper report states that under the first Five-Year Plan for forest rehabilitation and planting, dating from 1951, some 8,000 hectares of forest were to be restocked and improvement works carried out over 19,000 hectares. A total of 133 new tree nurseries were to be established with a production capacity of 48 million plants. This plan was fulfilled in four years.

The second national Five-Year Plan (1956-1960) also comprised a forestry program, involving the afforestation of 4,000 hectares, improvement works on 36,000 hectares, 120 kilometers of access roads and 60 kilometers of narrow-gauge railway. Additional sawmills with an annual production capacity of 40,000 cubic meters were to be set up. In 1948, there were 24 sawmills in the country with an output of about 60,000 cubic meters per year. At the end of 1951, an integrated wood industry plant (forestry combine) was set up at Elbasan with the help of Russian technicians. It has a yearly output capacity of 30,000 cubic meters of sawnwood and 5,000 cubic meters of plywood.

Since 1951, an Arbor Week has been organized annually, during which many thousands of trees of different species have been planted.

Australia

• An FAO representative was invited to attend the 7th British Commonwealth Forestry Conference which took place in Australia and New Zealand last year. Delegates from 18 countries of the Commonwealth, representing about one fifth of the world's forest wealth, joined in tours and discussions which lasted from the end of August until early October.

The substantive work of the Conference was done mainly in committee. The report of the Committee on Australian Forestry, adopted by the Conference, recommended that:

1. A detailed inventory of the indigenous forests, both those belonging to the Crown and those in private ownership, be undertaken urgently and completed by the time of the Commonwealth Conference in 1967.
2. All indigenous forests of actual or potential value on crown lands be dedicated as part of the permanent forest estate as early as possible, recognizing that well-managed forests not only produce timber of value but can at the same time serve other valuable purposes, particularly protection of water catchment areas.
3. The program of obtaining more complete utilization of, and affording silvicultural treatment to, indigenous forests, and of rehabilitating those degraded by fire and postselective logging, be accelerated.
4. The urgent need for more forestry research be met by the establishment of a Central Research Institute, with regional stations, under the Forestry and Timber Bureau, Canberra. An adequately paid research staff of high caliber is essential. It is the duty of the Bureau to deal with more basic problems and to assist in the co-ordination of the research activities of the States. The Bureau should be assisted in this task by an Advisory Committee composed of representatives of the Commonwealth and the various State Forest Services and the Commonwealth Scientific and Industrial Research Organization, together with a limited number of eminent scientists in other fields.

Chile

• Last December, Mr. A. Consigny, an FAO technical assistance officer accompanied a group of foresters of the Department of Conservation and Forest Resources, Ministry of Agriculture, to the extreme southern part of the country, Magallanes and Tierra del Fuego. The purpose of the visit was to enable the new Chief of the Forestry Division to inspect this remote area and to study to what extent forestry could be adjusted to sheep farming which, with the oil industry, is the main occupation in this region.

The officer reports that, except for the Monte Alto and Rio Rubens areas where very fine forests of *Nothofagus pumilio* merit protection and improving because of the excellent timber furnished, the entire territory is obviously destined, in time, to be used for sheep farming. The comparatively flat topography, combined with climate, relatively little cold and generally adequate moisture, favors the formation of extensive prairies. In the natural state there is a high proportion of nonpalatable plants and woody species called indiscriminately "mata negra" (*Verbena tridens, Berberis calafate, Mulinum spinosum, Escallonia rubra, Senecio patagonensis*).

The great enemy of the region is wind which, always very strong, frequently attains hurricane velocity. Periods of calm weather are, according to local inhabitants, quite exceptional. In many places the vegetation appears to drape the ground like a flag, a characteristic shape assumed as a result of the strong winds. The winds parch the herbaceous vegetation and cause severe drought in the absence of rain. The brush and scrub give the grasses some protection, but end by covering practically the entire ground. For the most part, the brush must be eradicated to permit extension of the sheep ranches. At present, the grazing capacity of an average ranch is one sheep per hectare. If the brush were cleared and the ground seeded with more palatable species, this capacity could easily be increased fivefold.

Except in the case of some privately owned areas, there has been so far little enthusiasm for clearing operations which are very costly. The reason for this is the present system of land leases, under which state land suitable for farming is classified into three categories according to its quality, and divided into lots of from 2,500 to 100,000 hectares depending on its quality rating. These lots are leased for 15-year periods to private persons who may raise sheep or carry on other types of farming or even forestry. However, at the end of the 15 years the land automatically reverts to the Government, without any indemnity to the former tenant for buildings, clearing, planting or improvement works.

The more the land has been improved, the more competitors there are for it and no priority is accorded a former tenant in allocating new leases. It is understandable that, under these circumstances, there is

little incentive to make improvements.

In addition to the three categories of farming land referred to above, provision does exist for classifying areas as forest reserves. There is a reserve of around 6,000 hectares in Tierra del Fuego, of poor quality and containing mainly the species called "leña dura" (*Maytenus magallanica*) which provides an excellent fuelwood but has no other possible use. Another reserve of 15,000 hectares in Magallanes has been devastated in the past but is now being vigorously cared for by the local forest officer and good regeneration has begun to appear, mainly of *Nothofagus pumilio* and *N. antarctica*. Unfortunately, at about 10 meters below ground there are coal seams which are being worked in several places, causing land subsidence, and the reserve offers a tempting source of free pit props.

The reserve clothes the banks of the Rio de las Minas, which empties into the port of Punta Arenas. Earlier devastation of the forest cover has caused serious erosion of the entire catchment area and consequently the silting up of the port. Attempts have been made to canalize the lower reaches of the river in order to prevent the floods that frequently inundate low-lying quarters of the town. The real solution is obviously to build dams in the upper portion of the river and reforest the catchment area which, together with other similar areas, should be classified as reserved forest.

A problem for the forester in this region is how to plant and establish effective windbreaks. Very few trees will grow readily, although the fact that there are some fine stands of *Nothofagus* proves that it is not impossible. It is to be noted that very fine woodlots are often grown on ranches behind high palisades of criss-crossed fencing which breaks the force of the wind. If the problem of windbreaks could be solved, this tip of South America might be transformed, permitting both better stock farming and the introduction of root crops.

China

• The Editor of *China Forestry*, a monthly periodical published in Peking, writes that early in December 1957 a conference called jointly by the Ministeries of Forest Economy and of Forest Industries reviewed the forestry work carried out in China during the last five years. At present, China has under 8 percent of its total land area under forest, very irregularly distributed. The aim is to expand the proportion to nearly 20 percent by the end of 1967.

A series of protective measures have been taken in recent years to preserve the country's existing woodlands. The State has passed forestry laws that restrict reckless cutting and burning of forests. Reliance on the masses is also followed in the fight against forest fires. The people are being aroused to appreciate the importance of trees. Fire prevention organizations are being set up. Fire prevention contracts are signed between villages in the forest regions.

In the last two or three years, 5,700 kilometers of forest roads have been built and more than 7,000 kilometers of telephone wire installed in the forests. The year 1957 saw the establishment of 37 weather and fire forecasting stations and 14 fire stations installed with chemical extinguishing equipment. In the northeast and the Inner Mongolian region where vast expanses of forests are located, aerial reconnaissance has been adopted. As a result, in many places no forest fires have occurred during these years.

An all-out onslaught has been launched against forest pests. Apart from chemicals dusted or sprayed either by hand or from planes, parasitic enemies of forest insects, such as the hymenopterous parasites, have been used. Forecasting outbreaks of forest pests has been started on a trial basis.

Once a sense of tree-consciousness is aroused among the masses, their initiative and creativeness brings many effective remedies. One measure accepted by the people is to facilitate natural regeneration by enclosing certain forest areas. It is claimed that 3,890,000 hectares were enclosed for natural regeneration in 1956 alone. In the five years, 1953-57, 5,910,000 hectares have been fenced off for natural regeneration.

The State has popularized this method and the peasants are keen on it, for it not only leads to flourishing forests, thus preventing soil erosion and inundation, but also provides rich supplies of firewood, fodder and manure. The example of Faku Hsiang (a hsiang is an administrative unit embracing several villages) in Liaoning Province of Northeast China is instructive. In 1951, the peasants of this hsiang enclosed 610 hectares for natural regeneration. Five years later, the enclosure was opened up for a time and yielded the villagers a total of 8,800 yuan (about $ 3,530) in forest products. What is more, thanks to the restored forest cover, more than 60 hectares of arid land could be turned into rice fields and the villagers bred silkworms in the regenerated forest. This brought the villagers another 20,000 yuan last autumn.

AFGHANISTAN: *A young* Pinus gerardiana *near the Khadei Pass, Southern Province. In some areas stands of* P. gerardiana *are preserved by the local people who derive a useful cash income from the collection and sale of the edible nut. The trees are, however, nearly all overmature and few young pines are able to get established, owing to the collection of the cones, removal of needles and litter from under the trees, and grazing. The species will regenerate naturally, and if protected and properly managed, could yield both edible nuts and a useful supply of wood.*

Courtesy, B. Clarke

The first Five-Year Plan provided for the planting of 3,550,000 hectares of timber trees. It is claimed that, by the end of 1957, 5,160,000 hectares were planted, topping the original plan by 45 percent. Eighty-five percent of the newly-planted forests are in the provinces south of the Yangtze River. More work has been done in the southern provinces because they have a long tradition of tree planting, and the warm climate, the high rainfall and the fertility of the soil bring on fast growth. For instance, in Chekiang Province pine trees need two thirds less time to form a close canopy than in the northeast provinces. Therefore, the area south of the Yangtze will become the main timber-producing region of the country in the future.

It is estimated that the new forests planted in the first Five-

Year Plan period will have begun to yield within 30 to 40 years. Taking an average timber extraction ratio of 150-300 cubic meters per hectare, the timber output yielded by these new forests will total upwards of 1,000 million cubic meters.

China's giant water conservancy works in the Yangtze River valley and the Huai River valley are well-known. But if trees are not restored to the upper reaches of some of the big rivers, especially the Yellow River, and if the devastating Gobi Desert is not curbed, no conservancy work can be regarded as complete. In fact, it would be of little use. This is why the building of shelterbelts and the planting of trees for water and soil conservation are so important in the afforestation program.

Sandbreak shelterbelts have been planted in the western part of northeast China, eastern Inner Mongolia, Hopei, Shensi, Honan and Kansu Provinces. It is also planned to build shelterbelts in the Turfan basin of Sinkiang and on Hainan Island. Surveying and prospecting of these areas is under way.

Tree planting for special forest products has topped the original plan by nearly 400 percent, it is said. In 1956, tung oil trees (*Aleurites fordii*) were planted on 600,000 hectares. Trees like the aniseed (*Illicium verum*), camelia (*Thea oleosa*), tallow (*Sapium sebiferum*), walnut and camphor (*Cinnamomum camphora*) have also been planted on a considerable scale, and the management of old forests of this category has been improved. The output of tung oil in 1956 was about 45 percent more than in 1949, and output of edible camellia oil in 1954, 30 percent more than 1950. Forestry work in this field not only helps meet the growing demands of the home market, but also supplies a large amount of raw material for export. Statistics from the Ministry of Foreign Trade show that, among the 23 items of raw materials exported in the past four to five years, 12 were forest products.

China has three research institutes specializing in forestry the Institute of Forestry under the Forestry Ministry in Peking, the Institute of Forestry and Pedology in Shenyang (Mukden), and the South China Institute of Botany in Canton, the latter two under the Chinese Academy of Sciences. In addition, each province has its own research center.

Costa Rica

• In 1955, the Committee on Economic Co-operation of the five countries of Central America (Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua) requested the Technical Assistance Board of the United Nations to make available, through FAO, the services of a forestry education expert for the purpose of expansion of the forestry education and training course already offered since 1950/51 by the Inter-American Institute of Agricultural Sciences.

In making this decision to assist the expansion of the forestry training program of the Turrialba Institute, the existence of forestry schools at Mérida, Venezuela, and Medellín, Colombia, was not forgotten but these schools are on a different basis in that undergraduates are admitted by them for a comprehensive forestry course including the basic sciences as well as their application to forestry, extending over four years, whereas Turrialba offers a one year's course of intensive training in advanced forestry to graduates only, especially agricultural graduates. In addition to the course of training, each graduate assistant (the title used at Turrialba Institute for students) is required to make a special study of a subject chosen by him, preferably a subject relevant to a specific forestry problem in his own country, and to prepare a thesis on this subject to qualify for the Masters degree conferred by the Turrialba Institute on successful graduate assistants. In other words, the course at Turrialba aims specifically at rounding off the training of graduates in science, giving it a definite forestry bias, thereby equipping them to be forestry leaders in their own countries.

Forest officers who are to assume administrative and/or executive responsibilities on a territorial basis, and forest officers who wish to specialize in forest research are equally necessary for a well-balanced program of forestry development. Experience of other countries, which have been fortunate in having had forest services for many years, shows that men who are successful administrators or executives are not always suitable for research, while gifted research officers may not fit in equally well in an administrative or executive post. The courses of training offered at Turrialba and Mérida Institutes, far from conflicting are complementary for forestry development.

It is obviously most desirable to have such forestry training available in Central America itself. Also centralization of postgraduate forestry training has many obvious advantages, especially when a number of small countries are involved. The Inter-American Institute of Agricultural Sciences, Turrialba, is unquestionably the most appropriate center in Central America. The Institute is supported by contributions from a number of member countries of the Organization of American States as an international co-operative project, has ample residential accommodation, classrooms and laboratories, an excellent technical reference library, facilities for experimental forestry on the Institute's estate, and is within easy reach of all important types of Central American forests. Further, qualified teachers in physiology, taxonomy, pathology, agricultural economics and extension are available for giving training in these related fields if required. The total cost of training, including living and travelling expenses during the year's course, is reasonable, amounting to approximately $2,000.

Mr. E. J. Schreuder was assigned to be FAO Forester at the Turrialba Institute from June 1955 until September 1956, when he was transferred to the *Instituto Latino Americano de Investigación y Capacitación Forestal*, Mérida, Venezuela, an international project of FAO's Latin America Forestry Commission. He was succeeded by Mr. A. Hyndman Stein.

Iran

• An interesting work on forest management has recently been written by Gholam Ali Banan, of the Ministry of Agriculture, Iran, and published in Persian. It contains a detailed account of classical methods of European and American origin which are applicable in Iran.

Following an introduction in which the writer explains in particular the relationships between silviculture and management, the work is divided into two sections. The first deals with the general principles underlying the work of forest management. And here the writer stresses the ideas of normal stand and potential yields, as well as describing the different kinds of harvesting methods. The second section describes management techniques and examines in turn the preparatory work (surveying, inventory taking, subdividing of stands into management units, etc.) and then the basic preliminaries (determining the potential yield, choice of silvicultural treatment and stand regeneration methods, and cutting rules). Finally, he examines particular cases: management of converted stands, parks and forests used by tourists, etc.

The writer makes particular mention of the reserve fund system which

is too often overlooked, although it has undeniable advantages in that it assures flexibility to management in coping with changes in economic situations.

The author does not make specific recommendations as to the methods best suited to the present forestry situation in Iran. He does not touch on the possibility of management for multiple use in forests where grazing is permitted, as happens so frequently in this country, nor the use of mountain areas for both grazing and forestry. However, his work places within the reach of Persian-speaking students and technicians an excellent reference book on problems of forest management and the methods by which they are solved in other countries.

IRAQ: *Two-year* Populus canadensis *in a large poplar plantation on the river "Bigger Zab" between Arbil and Mosul, and irrigated from the river.*

Courtesy, S. von der Recke

New Zealand

• The 7th Commonwealth Forestry Conference, to which reference has been made earlier in this issue, is described in detail in the December 1957 number of the *Empire Forestry Review*. In regard to the use of exotic species in planting programs, which formed one of the major themes of the Conference and in which of course New Zealand has considerable experience, the Conference invited the Forestry Institute at Oxford, England, to undertake the compilation and publication of a summary by species of the comprehensive information submitted to the Conference by member countries.

The venue of the next Conference in 1962 is to be East Africa — Kenya, Uganda and Tanganyika.

In regard to New Zealand itself, the Conference made the following recommendations:

1. The minimum area of indigenous forest necessary in the national interest should be determined and steps be taken to see that this area is brought into sustained production. The work of restocking partly stocked land in state forests should be intensified. Research into the problems of the indigenous forests should be increased.
2. In view of the high importance of controlled management of mountain catchments to New Zealand, where the whole standard of living is largely dependent upon a high level of agricultural and pastoral production for its lowlands, protection forest problems should, on completion of the protection forest survey already begun, receive the most careful attention from all appropriate authorities.
3. Exotic plantations should be diversified by the use of a wider range of species.
4. Early thinning and pruning should be carried out in all second-rotation crops of exotics, and, wherever practicable, in the younger first-rotation crops, even if such early treatment is not immediately remunerative.
5. There is need for new outlets and markets for forest produce in order that the exotic forests may be managed on a sound basis. Development of large integrated plants in the major forest areas is required, as is also the establishment of small-scale manufacturing units in other districts.
6. In view of the very real danger of disease and of insect attack, notably in exotic forests, there should be an intensification of precautionary and preventive measures.
7. Although there has been a notable expansion in forest research in New Zealand in recent years, there is urgent need for further increase in view of the numerous problems still awaiting solution.

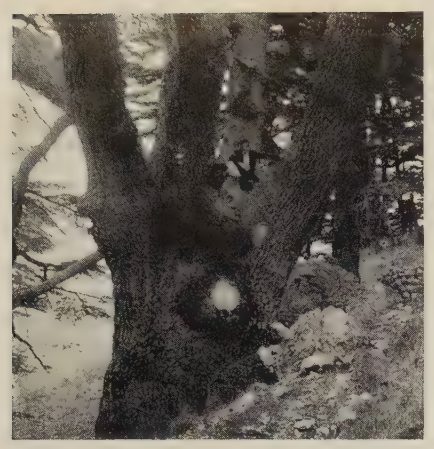
Philippines

• The Forest Products Research Institute is located on a 2-hectare compound in Makiling Park, not far from Los Baños, Laguna. It is a semiautonomous government institution attached for policy purposes to the University of the Philippines. It was created because of a growing consciousness of the necessity for more efficient and more complete utilization of the products of the forests of the Philippines.

Investigations on the properties and uses of wood were conducted in a small way by the Bureau of Forestry and the Bureau of Science, beginning about 1905. In 1926, a Division of Forest Products was created in the Bureau of Forestry to conduct research in this field and in 1933 this was converted into a section of the Division of Forest Investigations. A number of valuable publications were issued during these years that are still useful. In 1952, the establishment of a forest products laboratory was ordered, as a separate division of the Bureau of Forestry. It began its research in November 1954. On 5 July 1957, an executive order was signed by the President, which merged the Forest Products Section of the Bureau of Forestry with the Forest Products Laboratory into a new entity, the Forest Products Research Institute. The reorganization gave the new institute much freedom of action in conducting its business and carrying on its research.

The present methods of getting logs out of the forest and converting them into useful products leave many trees standing because they are defective or are species that cannot be marketed profitably. In addition, high stumps, large branches, tree tops and broken parts are left on the ground and only the saleable logs are removed. After the logs reach the mill to be converted into lumber, plywood and other products, there are additional losses in the form of sawdust, slabs, edgings, shaving, trimmings, bark and defective or broken pieces. Altogether, one half to two thirds of the wood in a tree cut from the forest is lost along the way from the forest to the final user.

The enormous amount of unused wood has great potential value as a



LEBANON: *Of the two areas of Cedar forest remaining, one at an altitude of 1,900 meters is only 2 hectares in extent. The biggest cedar in this forest is shown here. Extensive areas in the vicinity are now being afforested —* Cedrus *is sown and* Robinia *planted as a shelter tree.*

Courtesy, S. von der Recke

source of raw material for new wood-using industries and new products. For example, some of the wastes can be converted into wallboards, pulp and paper, charcoal, refined cellulose, bark extracts, small wood products, and various chemical products. These products can be made commercially only when it can be done at a profit. No commercial plant can operate long at a loss. One of the main problems of wood utilization research, therefore, is how to use wood residues profitably. This requires research and development on a large and continuing scale but big dividends will result to the nation in the long run.

The objectives of the research and development program of the institute may be stated briefly as follows:

a) to study the properties of the 3,000 different species of Philippine woods to determine the uses for which they are suited;

b) to study and improve the chemical processing, seasoning, preservative treatment and other manufacturing or improving processes so that the wood may be converted into final products more efficiently and more profitably and may serve the user better;

c) to develop new industries based on wood residues not now profitably used, and thus provide additional employment opportunities and economic advantages;

d) to find profitable uses for species not now being used and for species found to have special properties of value;

e) to undertake any other kind of research that will assist in the more efficient utilization of the products of the forest.

The Forest Products Research Institute and its research program have developed mainly out of the co-operative efforts of the Philippine Government which provided the buildings and pays the salaries and operating costs, the United States International Co-operation Administration, which provided most of the original research and operating equipment, and FAO which furnishes technical advisers, headed by Mr. G.M. Hunt, to assist in selecting equipment, training personnel, and developing the research program. These and many additional organizations and individuals contributed books and other materials, scholarships for training abroad and/or co-operative funds.

The Institute operates under the supervision of a Governing Board. The business and research are under a Director, and Assistant Director and five Division Chiefs, as follows:

Administrative Services Division — conducts the business and general operation and maintenance of the Institute.

Chemical Investigations Division — investigates the chemical composition of woods and other forest products, the manufacture of pulp, paper, wallboard and minor chemical products, and related problems.

Industrial Investigations Division — investigates the strength of woods, the problems of wood manufacturing industries, and the suitability of woods for special uses.

Wood Preservation Division — studies the physical properties of wood, durability of treated and untreated wood, preservative treatment and seasoning, the activities of insects and fungi that damage wood and methods for their control, and related investigations.

Wood Technology Division — investigates the microscopic structure and fiber characteristics of wood, methods for the identification of individual species, the relations between structure, properties and uses, the manufacture of veneer and plywood and other glued products, minor products of the forest, and related problems.

The staff of the Institute totaled 152 employees in January 1958. It consists of chemical, civil, electrical and mechanical engineers, chemists, technologists, botanists, foresters, entomologists, pathologists, administrators, clerks, skilled mechanics, woodworkers and laborers. It is necessary that all these skills be brought to bear on the research program in order that it may progress expeditiously on all its lines of investigation.

Switzerland

• The Forestry Division of FAO has noted with interest a publication entitled "*La Forêt et l'Economie pastorale dans le Jura*" (FORESTRY AND GRAZING IN THE JURA). This is a thesis prepared by Mr. E. Rieben, forestry officer at Vallorbes, for submission to the Federal Polytechnic School in Zurich, and represents a thorough study of the alpine pastures of the Swiss Jura, and more particularly of the French-speaking sector, comprising the cantons of Vaud, Neuchâtel and Berne. However, because of the writer's broad treatment of land-use problems and more specifically of land under forest and pasture in mountain areas and the relation between the two, the book is of general interest to all foresters who have to deal with these controversial problems.

The first part of this book describes the physical environment and past conditions that have led to the present aspects of the alpine regions of the French-speaking Jura. Practically all the pastures in this zone have been carved out of the forest by man and his herds and flocks. When the population was sparse the land was put to dual use, grazing and forestry, a practice still continued on more than 18,000 hectares, and the consequence was a distribution of the two uses which proved often unsound and even inimical to soil conservation. The Federal Forest Law of 1902, by including wooded pastures as part of the forest and prescribing "the maintenance of the present forest area of wooded pastures", has given foresters great responsibility in the treatment of alpine pastures.

The second part of the book is of more general interest. The author studies the reciprocal effect of two kinds of land use: forestry and pasture. He shows in turn the effect of grazing on the species composition of forest stands, in this particular case, the retrogression of fir and beech in relation to spruce, then its effect on soils and, lastly, the dire consequences of overgrazing. In his conclusion to the second part, the writer very clearly shows the need, under ecological and soil conditions in the Jura and within the framework of an economy that, as in this case, must make the maximum use of its soil productivity,

for a complete separation of the grazing and the forestry uses of the land. Naturally, this in no wise means that trees growing on pastures, especially shelter clumps or windbreaks, must necessarily be eliminated. Quite the contrary. These should be turned to the best account and, if necessary, trees should be planted and special measures taken to ensure their regeneration. They should, however, be considered as accessories to pastures where, if suitably placed, they are of great value. On the other hand, continuous tree cover occupying pasture-land areas capable of producing good quality forage should be removed.

On land reserved for timber production, grazing should be definitely and completely excluded. The distribution of trees to be left on grazing land will depend on local conditions and on the purposes in view, the main one in this region being to provide stock with a proper shelter against cold winds and bad weather, and to protect the soil against erosion caused by runoff on steep slopes. In general, single trees or thinly-stocked stands in which only poor quality and small quantities of forage are produced, should be eliminated, although under conditions other than those peculiar to the Jura (the author cites in particular the case of high-altitude larches in the Alps), such tree stands may be of particular value to pasture users.

The points that have to be taken into consideration in deciding on a judicious division of land for use as pasture and for forestry, now quite separate, are discussed in the third part of this book. The author examines successively the physical factors (site, geology, pedology, climate, and relief which together constitute the phytosociological group), then the economic and social factors. With regard to the economic factors, he notes that, taking as a basis the rentals from alpine pastures obtained by community owners, the cash income per hectare of pasture is usually only half the average income from forest land (60 as against 120 Swiss francs). He rightly concludes, however, that many other factors must be kept in mind; in particular, the considerable benefit derived by livestock and the mountain population from summering in alpine pastures.

The fourth part of the book is concerned with effective means of separating pastures from forests (by hedges and fencing) and methods of restocking or afforesting those areas where grazing is no longer permitted.

The elimination of grazing on land set aside for forests would normally entail the restriction of the number of head of livestock allowed to pasture. However, the author believes that there is absolutely no need for this in the Jura and that pasture improvement, described at length in the fifth part of his work, should make it possible amply to offset the loss of forage production of the areas withdrawn from grazing. It should be noted, however, that such improvement of pastures often requires complex technical methods and a labor force, equipment and capital which can certainly be easily assembled in the Jura, although it would be difficult to find them under other conditions.

Here also, operations of this kind are greatly helped not only by the trade unions or co-operative associations, of which pasture owners or lessees are themselves the prime movers, but also by substantial cantonal and federal subsidies. This contribution of the various parties interested in seeing these forest-pasture improvements achieved is discussed in the sixth part of the book. In conclusion, the author calls attention to the need for co-ordinating the efforts of all the parties interested in sound land use, and suggests setting up "an agency staffed with persons who have the necessary knowledge of biology, technology and political economy, to deal especially with problems of alpine forestry and pasture economy, and which can also effect liaison between the agricultural, forestry and pasture improvement services...", a very general recommendation which applies with equal force in many other regions.

United Kingdom

• Ultrasonic equipment has been used by the Timber Development Association for detecting flaws in wood, and its possible development for determining the presence of diseased tissues has been suggested. The principle of this type of flaw detection is to generate pressure (sound) waves of very high frequency which are transmitted through suspect materials such as metals or plastics. When flaws are present, the reduction of the degree of transmission in the defective area can be measured. Ultrasonic waves produced by commercial flaw detectors do not harm the materials being tested. The equipment is portable.

In these trials, transmission of ultrasonic energy through wood was measured both down and across the grain. After two areas, on exactly opposite sides of the samples, had been smoothed to give two flat surfaces, each about 25 square centimeters in area, the wood was smeared with a coupling agent to ensure good contact between the probes and the wood. To transmit across the grain the sampling areas had to be stripped of bark, which was found to be impenetrable to the ultrasonic energies employed.

The transmission of ultrasonic energy through wood is considerably reduced even when slight defects are present. The sensitivity could probably be increased with sets specially adapted for detecting flaws in timber. No transmission could be obtained through 5 centimeters of red pine infected with dry rot even though ultrasonic energy could be transmitted through 130 centimeters of sound seasoned beech.

Besides its potential value as a research tool for studying the ecology of tree disease organisms, the most important development of this technique would be the reduction of economic losses of timber. Trees of value are often lost because fungal infections (such as heart and butt rots) remain undetected for

PERU: *The FAO technical assistance officer in Peru sends this photograph of some beautiful mahogany logs awaiting loading onto 5-ton trucks near the main road from Pucallpa to Tingo Maria. Extraction is done by tractor skidding and loading by tractor equipped with bulldozer.*

Courtesy, M. A. F. Dijkmans

many years. The early detection of disease in an élite plantation would enable a decision to be made about its potential value and future management.

United States

• Forest Service activity in the field of forest fire research has been expanding during the past few years. Many local studies and some of general interest are under way. Among these are:

1. Fire danger rating.
2. Use for airplanes for dropping water and chemicals on fires in support of ground forces is being perfected (limited field use in California 1956 and 1957).
3. Helicopter accessories for water dropping and hose lays are being perfected for both small and large helicopters.
4. Tests of sodium calcium borate as a fire retardant have shown it effective on both small and large fires.
5. More information about thunderstorm origins and behaviors is being collected; it has been demonstrated that young, growing cumulus clouds, at least, can be broken up before they reach the lightning stage.
6. Development of drought indexes to help show cumulative effects of past adverse weather on current danger, has been initiated.

Plans call for continuing studies on some projects and new ones to be started as follows:

1. Use of airplanes will be tested in support of ground forces in the South.
2. Sodium calcium borate fire retardant will be tested in the South in both air and ground applications.
3. Skyfire thunderstorm detection and tracking studies together with cloud seeding tests will be expanded.
4. Study of blow-up fires will be strengthened.
5. Techniques for making wind surveys in critical local areas.
6. Field trials of methods for breaking up extensive brush fields to facilitate control.
7. Ways to increase the effectiveness of initial attack through both faster and stronger attack.
8. Systematic ways to recognize and to type fuels.
9. controlled burning techniques to get desired results with adequate safety.

• The quarterly *Fire Control Notes* of the United States Forest Service has, during 1957, been able to obtain more articles than usual which deal with broad aspects of fire control rather than with developments of implements and machinery, although the latter are not neglected.

One significant article by a senior officer of the Forest Service deals with the whole complex question of fire control planning as developed in the northern Rocky Mountain National Forest region. During the earlier years of Forest Service history beginning in 1905, this region was the scene of vast and tremendously damaging timber fires which, up to 1930, had burned an annual average of more than 252,000 acres (102,000 ha.). Much of the background reason for this tremendous loss was the inaccessibility of most of the forest areas, resulting in slow attack on many fires.

Then, with the invention of powerful machinery capable of building mountain roads rapidly and cheaply, the decade of 1931-40 was marked by a great extension of roads into inaccessible areas which resulted in the reduction of the average annual loss rate to 62,500 acres (25,300 ha.).

Toward the end of this period, the use of aircraft in forest fire control led to the development of the " smoke jumper " project and, during the years since 1951, the average annual loss rate has been reduced to 8,000 acres (3,240 ha.), undoubtedly helped by favorable weather conditions.

As each major step ahead in technology was paralleled by serious study of the problem, new and more complex systems of fire control planning had to be developed, each plan dealing with prevention, presuppression — that is, organization in advance of fires — and suppression. The major lesson from this 50-year-old development is that each new step ahead in invention and in research necessarily involves development of new plans and methods, and thus fire control planning is, in essence, a continuing project. Each major unit, whether federal or state, has evolved its own system of planning, but the one herein reported is recognized as one of the very good ones.

Another significant article dealing with the new tool, the air tanker, as it is developing in California, may give notice that again a fresh look at fire control planning is imminent. The air tanker as used in California in 1956 and in 1957 has some spectacular accomplishments to its credit. Initially, planes used in agricultural work were used to dump loads, first of water, then later of water with a heavy load of sodium borate, and to date this whole project is necessarily experimenting with a great number of special questions involving tactical use on difficult fires. So far, aerial bombing seems to be able to hold a small fire until initial attack forces arrive; cool down hot spots so that men can enter the area and work safely; knock down spot fires; build a fire-retardant line with borate in advance of a fire or where men cannot work; reduce the probability of crowning; strengthen existing firelines; directly support ground forces who are actively engaged in line construction; and fireproof local areas where spot fires are probable. But as yet the air tanker cannot knock down hot rolling brush or timber fires; safely make drops in high winds; make drops in the bottoms of steep canyons or other inaccessible places; cool down hot fires with heavy fuels under timber stands; nor work at night.

Use of this new tool has necessarily involved invention of new organizational devices, since ordinarily a fleet of tankers is used on a given fire, and the whole field of correct organizing and timing the supplemental operation of ground forces and tankers, still under process of development. So, too, is the building of a fleet of aircraft suitable for close-to-ground operations on often precipitous and extremely rough terrain. Transfer of aircraft considered obsolete by the United States Navy has meant a major advance in the sureness and safety with which bombing operations may be carried out.

Altogether, this very new method may again involve major reconsideration of the problems of suppression in the very hazardous heavy cover, fast spread types such as the brush in southern California and elsewhere, and in bad starts in inaccessible areas.

Any such technological advance connotes and requires that the men actually charged with putting out fires have a larger body of information that they need to know in order to use the new method most effectively. One of these is information about the principles of combustion and their significance in forest fire behavior, and an article in *Fire Control Notes* by a recognized authority in the field summarizes in understandable language what is now known on the subject.

Thus this magazine is bringing to its readers up-to-date information which a modern fire control officer must know and use.

Book Notices

Humanité et Subsistances [MAN AND HIS SUSTENANCE] André Guerrin. 492 pp. Scientific Library Series No. 31 *Les Editions du Griffon Neuchâtel*, Switzerland. 1957 Sw. Fr. 48.70.

This study deals with the basic problems of nutrition in the light of diminishing productive areas and increasing populations, but it is of interest to foresters in that the role of forest cover in attenuating " the regrettable factor of regression of the possibilities for cultivation of the soils of our planet ", and the feasibility of clearing new areas under forest for food production, are examined and discussed at the regional and even, in some instances, at country levels.

The author's chief preoccupation is with striking a balance between possible increases in food production and likely rates of increase in demographic pressure, and with reaching certain conclusions as to how an apparently critical situation may be improved. Foresters will be sorry that, in this context, he does not give more attention to the influence of forest cover and trees on agricultural production and in bettering crop yields; and that he entirely omits any consideration of the forest as a source of raw materials essential to economic welfare.

Many of the issues raised in this book are very complex and, despite the urgent need for action, much careful study is still required before a decision can be reached in regard to the author's recommendations. It is difficult for an organization such as FAO to accept in particular certain conclusions put forward by Professor Roger Heim in his preface. This does not, however, detract from the value of the wealth of factual data contained in Mr. Guerrin's review, in helping the reader form his own opinions about an immediate and fundamental problem facing mankind.

Forest Trees of Australia. Forestry and Timber Bureau, Commonwealth of Australia. 230 pp. illus. Govt. Printing Office, Canberra, 1957 £ 2.2s. (Austr.).

Here is a very fine book describing 82 native Australian forest tree species. Of these, 67 are eucalypts, 7 other broadleaved, and 8 coniferous species. There are colored and black and white illustrations.

The first chapter provides a concise summary of the vegetation of Australia, covering treeless communities, and tree-dominated and mallee communities which are subdivided into mallee and low rainfall woodland, woodland, and forests; the latter is further distinguished as sclerophyllous or rain formation. This is followed by a brief description of Australian forest trees and groups including general introductions on the hardwood genera, principally the Myrtaceae consisting of *Eucalyptus* (95 percent of Australia's forest area), *Angophora*, *Syncarpia*, and *Tristania*, and including *Acacia* of the Leguminosae and *Casuarina* of the Casuarinaceae; and on the softwood genera of *Agathis*, *Araucaria*, *Callitris*, *Athrotaxis*, *Dacrydium* and *Phyllocladus*.

The Eucalypts are classified on the basis of the structure of the anthers of the flowers into three major sections: those with oblong anthers, with two long parallel slits; those with kidney-shaped anthers with a single opening; and those with box-like anthers with two pore-like holes. Although there is hybridization among species within each section, no such hybridization has been recorded between species of different sections. Within these three anther divisions, groups are recognized according to bark, foliage, flower, buds, and fruit, all characters which are readily identifiable in the field in a general way. From a study of the common names of the species in these various groups, it is clear that it is safer and less confusing to use only the Latin names.

The book should be a valuable reference outside Australia to foresters concerned with the introduction and cultivation of Eucalypts, and the Director-General of the Australian Forestry and Timber Bureau and the other contributors to this volume, deserve to be congratulated and thanked for issuing it.

The Federal Lands: Their Use and Management. Marion Clawson and Burnell Held. 500 pp. Index and statistical appendices. Published for Resources for the Future, Inc. by The Johns Hopkins Press, Baltimore. $ 8.50.

This book constitutes a history of the federal lands of the U.S.A., a review of the land use policies applied to them and of the administrative methods through which these policies are implemented, a critical analysis of achievements through these methods, and finally a tentative projection into the future of the role of these lands in the country's economy, with suggestions for increasing the efficiency of their management.

All these factors are actually closely interrelated and it would be difficult to understand the present-day management of these federal lands without a study, at least in major outline, of their history through what the authors call the eras of land acquisition, disposal to private persons, reservation, custodial management, and finally intensive management which began only about ten years ago.

The policy applied to 376 million acres of rural federal land (excluding Alaska, the Indian reservations and lands in the hands of the Department of Defence) has been one of multiple use. The authors explain clearly not only the framing of this policy, which sets certain priorities for one or another type of land use for each area, but also describe how the products of these lands are utilized by certain groups of beneficiaries or by the public as a whole. In particular, they show the influence on the formation of this policy of organized groups, demonstrating the machinery of decision-making from the level of the humblest local organization to the Congress and the President of the United States.

The management of federal lands is entrusted to a great many government agencies, the four principal being:

1. the Forest Service, which administers the national forests;
2. the Bureau of Land Management, which manages grazing lands outside the national forests, land derived from the partial revestment of the areas originally conveyed as grants to the Oregon and California Railroads (which included large forested tracts) and other public domain lands, and finally the submerged areas of the outer continental shelf lands, the so-called " offshore " lands, where oildrilling concessions have been awarded lately;
3. the National Parks Service which administers 9 million acres reserved for their aesthetic beauty and touristic attraction, as well as a certain number of historical sites, battlefields, cemeteries, national monuments, etc., and the federal capital parks;
4. the Fish and Wildlife Service which is in charge of a certain number of wildlife refuges and also helps some of the above-mentioned services or the States to manage other public domain lands.

For each of these four government agencies, the authors consider the relative, present and future (up to 1980) importance of the main uses of the lands under their control, namely: for grazing, timber harvest, hunting and fishing, recreation, as watersheds and for stream flow control and the locating and exploitation of mineral resources.

Of particular interest is Chapter 4 in which the authors analyze the various factors which enter into pricing processes in order to arrive at unit prices for products extracted from federal lands, and also factors which influence the formation of investment capital to be used to heighten the productivity of such lands. In this connection, one will note their critique of the system of abandoning to individual states and counties, in lieu of the taxes which they are not permitted to levy on federal lands, of a large portion (25 to 75 percent) of the revenue from these lands.

Despite the difficulty of drawing a distinction between investment and current expenditures (except for the Forest Service which makes such a breakdown in its own bookkeeping statements), the authors were able to estimate the gross revenue from these federal lands for 1955 and 1956, compare them with expenditures and forecast the course of events up to 1980. This balance sheet shows a good profit both at present and for the future, but this is due entirely to the revenue from the leasing of offshore lands, and turns into a deficit if this revenue is subtracted from the total figure.

The authors conclude their study by showing that, because of the ever-growing complexity of the problems involved in their management, the era of intensive management of federal lands now entered upon will lead to profound changes in the methods applied to them. They establish the principle clearly that the purpose of such management should never be the seeking at all costs of maximization of net monetary income. It should, they believe, come closer than it now does to a commercial business enterprise whose transactions are carried on directly with the public, and which earns an income that makes it potentially self-sustaining without recourse to appropriations. But it requires more flexible budgeting and commercial audit, not customarily permitted for an ordinary government agency.

This result can be achieved by various methods, which the authors study in detail. However, they seem to favor the substitution for the present management systems of a federal land corporation, a type of government enterprise already common in the United States, which enjoys a great deal of autonomy and to which the criteria just mentioned could easily be applied. In addition, it could be relieved of non-revenue-producing functions now being performed by the agencies concerned, for instance, the research and technical assistance work of the Forest Service. Such activities would then continue to be conducted by the normal type of government agency.

Franklin D. Roosevelt and Conservation — 1911-1945, Volumes I and II. Compiled by Edgar B. Nixon, United States Government Printing Office, 1957.

The public and private papers of a leading public figure often reveal insights into his personal interests and significant accomplishments which too frequently escape the historian dealing only in broad political issues. That this is particularly true of Franklin Roosevelt has been demonstrated in this 1,300 page collection of his papers on forestry, soil, water and wildlife, park conservation and natural resource planning.

There is an underlying reason for Roosevelt's broad interest in natural resource problems: he was a countryman at heart. He had what Aldo Leopold has called " an ecological conscience ". Many pages of his letters, conference reports as well as written speeches, reveal a man with an awareness of trees, wild things and a " feel " for the land — not as a sentimentalist, but as a practical realist. Only a man who had reforested his own acres with tree species he himself had carefully chosen and who had watched them grow, would have the vision needed to create and stoutly defend a national reforestation program so that unemployed city boys might have similar experiences in the Civilian Conservation Corps.

These volumes do not include any of Roosevelt's papers on public power or reclamation except insofar as they were related to the general field of resource planning. Presumably, papers on the Tennessee Valley Authority, Rural Electrification Administration and other water developments will be included in another collection. There is much evidence to indicate that he was primarily interested in integrated management of resources — particularly river basin and regional resource planning. The T.V.A. and the National Resources Planning Board were pioneering efforts in this respect.

His conservation programs were established largely during his first and second administrations before the second world war. To review them all would require more pages than should be allotted to any reviewer; but the impact of their sheer numbers cannot be appreciated without a listing of the highlights: establishment of the Soil Conservation Service, of 159 new National Wildlife Refuges, of the National Parks of King's Canyon, Great Smokies and Isle Royal and of a number of national monuments; the first national water pollution control act; the Taylor Grazing Act of 1934; the Duck Stamp, Pittman-Robertson and Wildlife Co-ordination Acts (all landmarks in wildlife conservation); the Quetico-Superior Wilderness Committee; expansion of the National Forests by 13 million acres; the Plains Shelterbelt Act; and the Norris-Doxey Farm Forestry Act. There are many other major forward steps in existing programs which had received no progressive help for years.

Roosevelt's personal interest in conservation was fertile ground for early leadership in conservation policy when, as State Senator in Albany, he sponsored the Roosevelt-Jones Wildlife Protection Bill. His first real controversy with the former Governor of New York came in 1931 over the Reforestation Amendment (designed to retire and reforest submarginal New York State lands) when the latter opposed it as being unnecessary. (It was approved by a large majority of voters). These early experiences were fostered by his personal friendship with Gifford Pinchot as early as 1911. On many occasions during his career, Roosevelt sought out and used some of Pinchot's advice on forestry matters. And it is of interest to note that Pinchot and Roosevelt were planning a World Conference on Conservation shortly before the President's death. In due course this materialized as the United Nations Scientific Conference on the Conservation and Utilization of Resources.

As a participant in several New Deal conservation programs beginning with a job as a forestry foreman in a C.C.C. camp during college years, this reviewer felt that he had a reasonably detailed knowledge of conservation in the New Deal; but these two volumes open up many new insights into Roosevelt the man, Roosevelt the political leader, and Roosevelt the conservationist, which will be instructive to both the professional foresters as well as to laymen. No historian of the 1930's henceforth can afford to overlook this dynamic and lasting chapter of American history.

C. H. S.

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